



THE  
AMERICAN PEOPLES  
ENCYCLOPEDIA

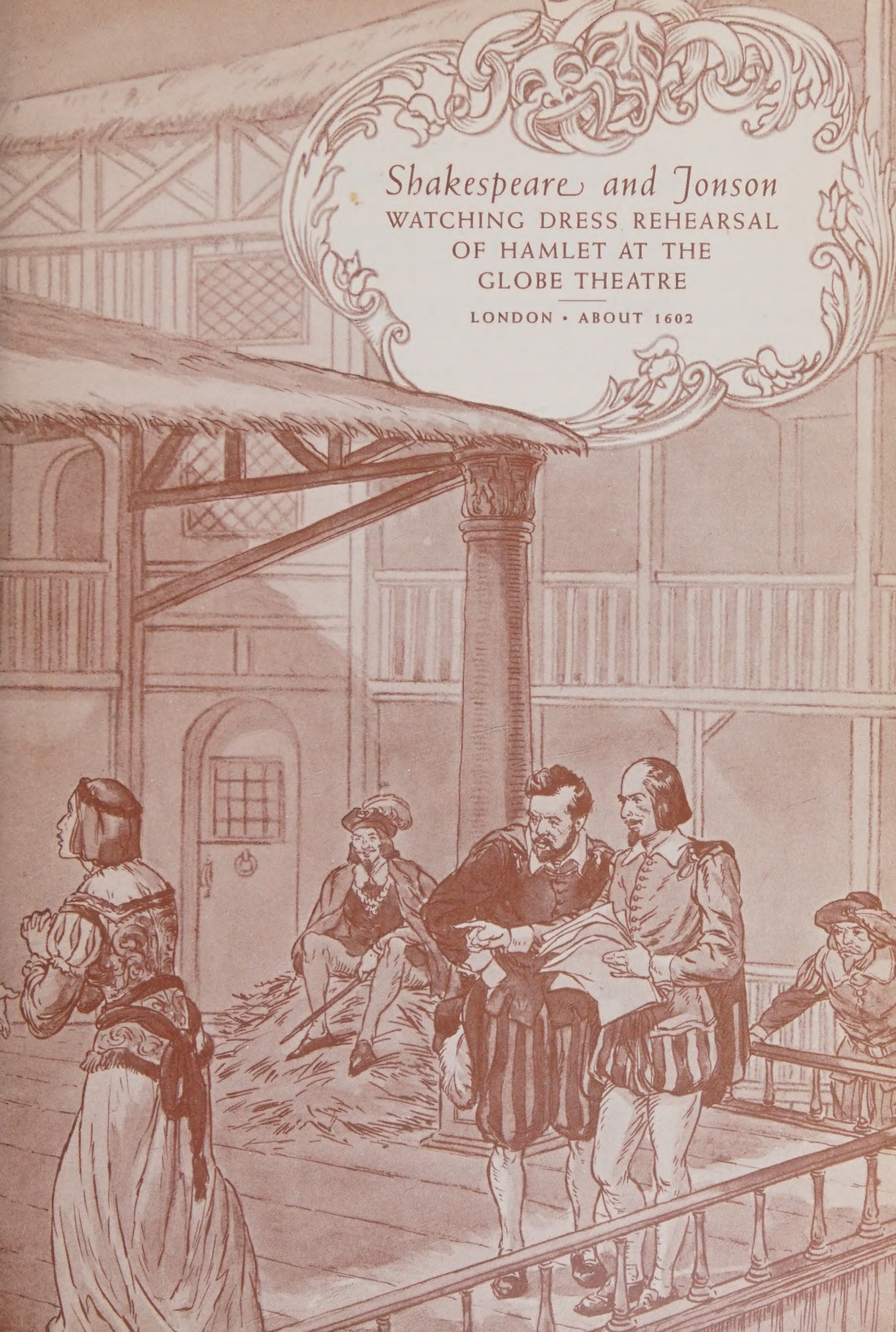






*Shakespeare and Jonson*  
WATCHING DRESS REHEARSAL  
OF HAMLET AT THE  
GLOBE THEATRE

LONDON • ABOUT 1602







## SHAKESPEARE: GREATEST OF WRITERS

*He Plumbed the Depths of Every Human Emotion*

THE BIBLE and the works of William Shakespeare (1564-1616) are frequently mentioned together as the two loftiest peaks in world literature. Could greater tribute be paid to any man?

Victor Hugo, the impassioned French poet and novelist, dramatized his conception of Shakespeare's eminence in the following characteristic manner: "Homer, Job, Aeschylus, Isaiah, Ezekiel, Lucretius, Juvenal, St. John, St. Paul, Tacitus, Dante, Rabelais, Cervantes, Shakespeare. That is the avenue of the immovable giants of the human mind."

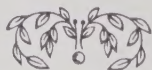
Goethe, himself almost in a class with the Bard of Avon as a poet and dramatist, went even further. "Shakespeare," said he, "... exhausted the whole of human nature in all its tendencies, in all its heights and depths ... in fact there remains for ... the aftercomer nothing more to do."

About Shakespeare's life little is definitely known and much has been written. He was born in Stratford-on-Avon, England. His father's financial reverses made it necessary for William to go to work in his early teens. In 1582, at the age of 18 or 19, he married Anne Hathaway. When, about two years later, he left Stratford for London, he was already a father. He began his literary career as a writer of sonnets and narrative poems. But by 1592 he had achieved recognition as a playwright.

According to one tradition, Shakespeare's first employment in London was holding horses in front of a theater while their owners were inside watching a performance. From this he is said to have advanced to acting. But he never showed much talent as an actor, and played only minor roles such as that of the Ghost in *Hamlet*. As a dramatist, however, he achieved both financial and critical success. His income from writing and from his interests in the production of plays, including part ownership of the famous old Globe Theatre, made him financially independent by the time he retired to Stratford in 1610.

Most scholars credit him with the writing of 38 plays. The greatest of these are *Hamlet*, *King Lear*, and *Macbeth*; and of these three *Hamlet* is usually rated highest. Shakespeare's superlative genius was recognized in his own time, at least by the most discerning of his contemporaries. This is borne out by the famous remark of his friend Ben Jonson, the most scholarly of Elizabethan dramatists: "I loved the man [Shakespeare] and do honor his memory, on this side idolatry, as much as any."

After his death there were times when his greatness was not fully appreciated, but even as early as 1668 John Dryden spoke of Shakespeare as "the man who of all Modern, and perhaps Ancient Poets, had the largest and most comprehensive soul." See *DRAMA, Elizabethan Drama*; *ELIZABETH (Queen of England)*; *GLOBE THEATRE, THE*; *HAMLET*; *JONSON, BEN*; *SHAKESPEARE, WILLIAM*.





# *The American Peoples* ENCYCLOPEDIA

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WALTER DILL SCOTT, Ph.D., LL.D.  
*President Emeritus, Northwestern University*  
*Chairman of the Editorial Board, 1945-1955*

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**GUANCHE**, or **GUANCHO**, a name applied to the native residents of the Canary Islands. They are of particular interest because of their supposed relationship to **CRO-MAGNON MAN** of Paleolithic times and to the Berber tribes of North Africa (see **BERBERS**). Verneau, who has given the best account of these people, calls attention to several resemblances to the former. According to him the men ranged in height from five feet and seven inches to six feet and seven inches, with an average above six feet. The women, like those of Cro-Magnon, were several inches shorter. The head was extremely long, with domed forehead and pronounced parietals. Dr. von Luschán gives further details in which Cro-Magnon features are evident.

Others who have noted physical resemblances of the Guanche to the Berber tribes of North Africa call attention to hints that their languages were related. This might be accounted for by a Cro-Magnon element in the Berbers or by their migration as far as the Canary Islands. Perhaps the most convincing suggestion of Cro-Magnon relationship is the fact that until after the Spanish invasion, in the 15th century, the Guanche used stone tools and lived in caves the walls of which they decorated with designs in red ochre and gray lines. However, the art differed from that of Paleolithic times by being geometric.

Some writers have sought to prove Egyptian influences because the Guanche embalmed some of their dead. This embalming consisted in treatment of the body with a resinous substance but lacked other features of the process found in the Valley of the Nile.

Stripped of all speculations the Guanche present interesting survivals of Old Stone Age life and customs. They were powerful and warlike when the Spanish invaded their islands. Many were killed, others were enslaved and later merged with the newcomers. There are no pure Guanche survivors.

FAY-COOPER COLE

**BIBLIOG.**—R. Verneau, *Cinq années de séjour aux îles Canaries*, (1891); Al de Espinosa, *The Guanches of Tenerife*, (1907); H. F. Osborn, *Men of the Old Stone Age*, (1923 edit.).

**GUANINE**, ( $C_5H_5N_5O$ ), is a complex nitrogenous compound of basic character that is allied to uric acid, and is found in guano and other animal products. It is extracted from guano, and forms a white powder insoluble in water.

**GUANO**, town, central Ecuador, in Chimborazo Province; on a railway and the Pan American High-

way and the like, together with other animal remains, as birds' feathers and bones. It possesses a pungent, characteristic odor and varies in color from light to dark brown. The most important sources are the islands near the western coast of South America.

The main constituents of guano are nitrogenous (uric acid) and phosphatic (calcium phosphate) but potassium salts are present, together with urate, oxalate, ulmate, phosphate, carbonate, sulfate, and chloride of ammonium, and a nitrogenous compound called **GUANINE**. In hot and rainless regions the nitrogenous matter is preserved by natural desiccation, so that its ratio to phosphatic matter remains high; in damp climates it is almost entirely decomposed into ammonium salts and is lost by drainage and vaporization. In the former case nitrogenous guano results, and in the latter case phosphatic guano.

The high manurial value of guano is due to the fact that it is a general fertilizer, yielding all the constituents of plant food in a condition that can be readily assimilated. The best supplies are now practically exhausted. Its use in the United States has largely been superseded by synthetic fertilizers.

**GUANTÁNAMO**, city, SE Cuba, in the province of Oriente, on the Guaso River; 13 miles by rail N



U.S. NAVY PHOTO

### U.S. Navy ships anchored in Guantánamo Bay

of its port, Caimanera, on Guantánamo Bay. It is situated in a rich agricultural section and has considerable trade with the United States in coffee, lumber, and sugar. Guantánamo Bay, by an agreement made in 1901, is a United States naval station. For many years it has been the winter headquarters of the U.S. Atlantic Fleet and the scene of annual target practice. During World War II, it became one of the chief United States defense bases from which the fleet guarded sea and air lanes. Pop. (1943) 42,445.

**GUAPORÉ**, territory, NW Brazil, bordering Peru and Bolivia; area 98,132 sq. mi.; pop. 37,438. This sparsely settled territory, organized in 1943, is one of the six federal territories which form a belt around Brazil. Pôrto Velho is the capital.

**GUAPORÉ RIVER**, South America, rises in W Brazil in Matto Grosso and flows NW between Brazil and Bolivia. After uniting with the Mamoré, the Guaporé enters the Madeira. It is about 700 miles long.

**GUARANA**, a beverage made from the reddish-brown seeds of a climbing shrub, *Paullinia cupana*, found principally in the Amazon valley. The seeds contain an alkaloid called guaranine which is akin to the caffeine in coffee and tea. By mixing the



ACME

### Scene on a guano island off South America

way, S of Quito, in an agricultural valley flanked on one side by high cliffs. The Indian population engages in shredding hemp and making sacks on primitive looms. Wool textiles and fine rugs also are produced. Pop. 4,477.

**GUANO**, a valuable FERTILIZER formed from the excreta of fish-eating seafowl, such as gulls, cormorants, and penguins, and also of walruses, seals,



ground seeds with water and cassava flour and then molding the paste into sausage-shaped cylinders which are dried over an open fire, the Indians preserve guarana for future use. The beverage is prepared by pulverizing part of a cylinder and then adding hot or cold water. Guarana contains up to 4.5 per cent of caffeine which makes it more stimulating than coffee, tea, chocolate, or maté.

**GUARANDA**, city, W central Ecuador, capital of Bolívar Province, in a mountainous region about 37 miles W of Riobamba. Several of the highest peaks of the Andes are near the city. Guaranda is an important market for cinchona bark, timber, and grain. Pop. (1944 est.) 15,606.

**GUARANI**, the most widespread of the South American aborigines, whose domain originally comprised a great part of central and southern Brazil, Paraguay, Bolivia, Argentina, and Uruguay. Jointly with the kindred Tupi, they constitute the Tupi-Guarani family, which further occupied most of the eastern seaboard south of the Amazon estuary, and reached inland to the eastern slopes of the Peruvian Andes. Their astonishing expansion appears to be mainly due to peaceful migratory movements. Physically the Guarani are a robust but somewhat under-sized race, with round face and rather flat features, slightly oblique eyes, and a yellowish complexion. At present, full-blood Guarani are nowhere numerous; those settled by the Brazilian government in reserves are nearly all half-castes.

BIBLIOG.—S. K. Lathrop, and A. Metraux in *Handbook of South American Indians* (1946).

**GUARANTY**, or **GUARANTEE**, a collateral promise to answer for the debt, default, or miscarriage of another person. It is distinguished from **SURETYSHIP** generally in that it is a secondary obligation, often made subsequent to the primary obligation which it guaranties, while suretyship is a primary obligation (the surety being bound equally and at the same time with the principal). Thus, in order for a creditor to collect on a guaranty, he must first exercise due diligence in attempting to obtain payment from the principal debtor, which is not required in suretyship. Guaranty contracts fall within the Statute of Frauds (see **FRAUD**, *Statute of Frauds*) and must be in writing, although there are many types of parol (oral) agreements in the nature of a guaranty which are held to be valid. A guaranty is a contract and is subject to the general rules applicable to contracts, such as, for example, the requirement of consideration for the promise. The principles of law applicable to guaranty and suretyship are closely related and it is often difficult to distinguish one from the other; what in one jurisdiction may be labeled as a guaranty may be considered as a suretyship in another.

**GUARANTY COMPANY**. See **TITLE GUARANTY COMPANY**.

**GUARANTY DEPOSIT LAW**. See **BANKS AND BANKING**; **FEDERAL DEPOSIT INSURANCE CORPORATION**.

**GUARATINGUETA**, town, SE Brazil, in the state of São Paulo; on a railway and highway about midway between Rio de Janeiro and São Paulo, in a grain and livestock-raising section. The town is a market center for the agricultural region. Pop. (1940) 15,654.

**GUARAYOS**, South American aborigines, of Tupi linguistic stock, who roam the forests of eastern Bolivia. They are noted for their florid complexion and full beards. Although they cultivate maize and plantains, they are described by some observers as a fierce and barbarous people.

**GUARDA**, district, E Portugal, in the province of Beiras, bounded on the N by Bragança, on the E by Spain, on the S by Castelo Branco, and on the SW and W by Coimbra and Viseu; area 2,122 sq. mi.; pop. (1940) 294,166. It is drained by the Douro (Duero), which forms its northern boundary, and its tributaries. In the southwest the Serra da Estrela reaches heights of 6,000 feet. The province is rocky and generally of poor soil. Grain, oil, and wine are

the chief products, and sheep are raised. The chief town is Guarda.

**GUARDAFUI, CAPE**, the NW extremity of the eastern horn of Africa (11° 50' N and 51° 20' E), at the S entrance to the Gulf of Aden.

**GUARDIA, TOMAS**, 1832-82, Costa Rican general, was born in Bagaces, Guanacaste. He led in the revolt against Jiménez in 1870, and became chief of state. From 1870 to 1876 he was president, and made many improvements.

**GUARDIAN AND GUARDIANSHIP**. A guardian, in law, is a person legally invested with the power and charged with the duty of taking care of the person or managing the property (or both) of another person who, because of some peculiarity of status or defect of age, understanding, or self-control, is considered incapable of taking care of himself or administering his own affairs. Among those for whom guardians are frequently appointed are **INFANTS** (that is, those below legal age), insane persons, imbeciles, lunatics, feeble-minded persons, spendthrifts, and habitual drunkards. When a person has been found by a court of proper jurisdiction to be mentally incompetent, the law requires that a guardian be appointed. In some states, the term guardian is limited to those appointed to care for the person or property of one who has not reached legal age. In other states, a guardian includes anyone who has been appointed to look after the person or property of any mentally incompetent person. In some states, the term *committee* is used. In others, *conservator*, *trustee*, or *curator*.

The most common forms of guardianship are: (1) guardianship of property; (2) guardianship of person; (3) general guardianship, which includes care of both person and property; (4) natural guardianship (in most states, the father, but if he is dead, then the mother); (5) testamentary guardianship, under which a father may nominate a guardian for the estate bequeathed by him to his child; (6) guardianship by election, under which, in most states, an infant is permitted to select his own guardian upon attaining the age of 14 years, if the selection is approved by the court; (7) guardianship by judicial appointment. Most modern guardianships come under the latter head.

Normally, the first step in obtaining the appointment of a guardian is for those interested to file a petition with the proper court, stating: (1) the name of the ward; (2) the nature of the legal incompetency of such person; (3) the fact that he does not already have a guardian; (4) the estimated amount and character of his property; (5) the name of the proposed guardian. After appointment by the court and proper qualification, the guardian enters upon his duties, which are: (1) to assemble the property of the ward; (2) to conserve the property; (3) to manage the property; (4) to use the property for the benefit of the ward; (5) to make proper accounting of the administration; (6) to deliver the property to the ward or to his personal representative, if he is dead at the termination of the guardianship.

The powers of a guardian, like the powers of an executor, administrator, and trustee, fall into three classes: (1) Inherent powers, those which are incidental to the office and without which the office of guardian could not be performed; (2) Express powers, those found in the statutes; (3) Implied powers, those that grow out of the guardian's inherent and express powers. Infants and incompetents are the objects of the solicitous care of the courts. In many cases, the standards required of a guardian are even higher than those required of a trustee.

**ROBERT KRATOVIL**  
**GUARDS**, picked regiments or corps forming the personal guard of the sovereign. In the British army the Household Brigade consists of the Household Cavalry, two regiments, Life Guards and Royal Horse Guards; and H.M. Brigade of Guards (foot), five regiments, 1st or Grenadier Guards, Coldstream Guards, Scots Guards, Irish Guards, and Welsh



## Guarico

Guards. A famous regiment of guards was the Swiss Guard, formed in France in 1616, which was massacred in defending Louis XVI in the Tuileries (1792). The Imperial Guard (of France) was organized in 1804 but was disbanded in 1815. During its final campaigns it was supplemented by the Young Guard. Both the Old Guard and the Young Guard were present on the field of Waterloo. The pope has a company of Swiss Guards, and there were Imperial Guards in Russia and Prussia.

DON RUSSELL

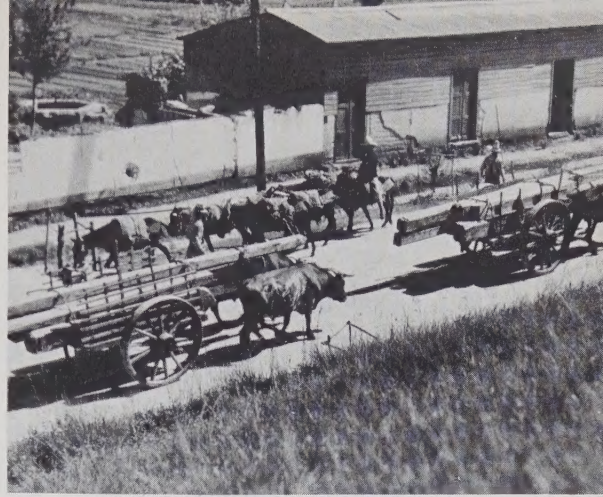
**GUARICO**, inland state, central Venezuela, bounded on the S and SW by the Portuguesa and Orinoco rivers, on the W by Cojedes Province, on the N by Aragua and Miranda provinces, and on the E by Anzoategui Province; area, 25,637 sq. mi.; pop. 163,505.

**GUARINI, GIOVANNI BATTISTA**, 1537–1612, author of the celebrated drama *Il pastor fido*, was born in Ferrara. He was a contemporary of Tasso, and courtier successively to the dukes of Ferrara, the Medici, and the House of Urbino. The book is a brilliant work, reflecting the manner of life, vices, and superficialities of the age.

**GUARNERI, GUARNIERI, or GUARNERIUS**, the surname of an eminent Italian family of violin makers who worked at Cremona, including Andrea (c. 1630–98), a pupil of NICOLA AMATI; Joseph (c. 1666–c. 1739), son of Andrea; Petrus (c. 1670–1728), the second son of Andrea, associated with Cremona and Mantua; Petrus (c. 1695–c. 1765), son of Joseph; and Giuseppe Antonio (1683–1745), a nephew of Andrea, popularly known as Guarneri del Gesù, because of the letters "I. H. S." written on many of his labels. His violins, which date from 1740 to 1745, are considered by many to equal the best productions of Stradivari.

**GUATEMALA**, northernmost of the republics of Central America; bounded on the N and W by Mexico, on the SE and S by El Salvador and the Pacific Ocean, and on the E by British Honduras, the Caribbean Sea, and Honduras; area 45,542 sq. mi.; pop. (1950 census) 2,787,000.

**Physical Features.** The surface of Guatemala has great variety, marked by extensive plateaus, terraces, and valleys. The main mountain chain is the SIERRA MADRE, running generally parallel with the Pacific Coast and about 50 miles inland. On the Pacific side, the slope is steep and broken by many volcanoes;



EWING GALLOWAY

### Oxcarts transport lumber to Guatemala City

highlands, where the elevation is from 4,000 to 11,500 feet above sea level. Dense jungles border both the Caribbean and the Pacific coasts. Most of the volcanoes of the Sierra Madre region are extinct, the only active ones being Fuego (12,570 ft.) and Santa Maria (12,300 ft.). The highest peaks are Tajumulco (13,808 ft.), Tacaná (13,300 ft.), Acatanango (13,000 ft.), and Atitlán (11,562 ft.).



Guatemalan coat of arms

The rivers flowing from the steep Pacific slope of the Sierra Madre range are short and torrential, but on the Caribbean slope the Motagua and Polochic attain a length of 250 and 180 miles respectively. The Usumacinta, which forms a part of the boundary between Guatemala and Mexico, flows northwest into the Gulf of Mexico. Guatemala is noted for its blue volcanic

lakes. Among the largest are the Golfo, Dulce, Petén Itza, Atitlán, Amatitlán, Ayarza, and Guija.

Varying altitudes provide a wide range of climate in the republic. The coastal jungles and the northern lowlands are hot and humid, with annual temperatures averaging 80° F. The temperate plateaus of the interior have an agreeable climate and are populous, while the mountainous districts, with an altitude of more than 6,000 feet, are cold and more sparsely settled. Earthquakes are frequent. The average rainfall is copious, especially on the Caribbean coast; it ranges from 45 inches to nearly 200 inches in the jungles. The rainy season extends from May to October in the interior, but may last until December in the coastal districts. The soil of the country is rich and vegetation is dense and quick-growing.

**Plants and Animals** of Guatemala are typical of Central America. The lowlands are lush and tropical; the temperate highlands have great masses of towering shrubs and vines; and on the high mountain slopes there is little vegetation. In the highlands at least 150 varieties of timber have been found, but in the lowlands large areas of wooded jungles are not yet explored.

Guatemala has a superfluity of insects. There are many deer, also armadillo, wild pig, puma, jaguar, bear, and tapir. Alligators and blue herons are found in the tropics. The quetzal, a bird of gorgeous plumage, has been adopted as the national emblem, and its name has been given to the national currency



Location map of Guatemala

toward the Caribbean it sinks in gentle incline, with subsidiary ranges extending to the water's edge. The great northerly plateau of Petén comprises nearly one-third of the area of the republic. It is a densely wooded tropical region with few inhabitants. Most of the people live in the agreeable climate of the central





MIDDLE AMERICA INFORMATION BUR.

### Typical Indian boy of Guatemala

unit. The national flower is the white nun orchid, which grows wild in the forests of Verapaz.

**People.** Nearly 60 per cent of the people of Guatemala are pure Indians, whose colorful costumes and picturesque ways of life add interest to the country. The other natives are mixed Indians and Spanish, and the ruling class is of European descent. The great concentration of people is in the interior.

| PRINCIPAL CITIES            | POPULATION  |             |
|-----------------------------|-------------|-------------|
|                             | 1940 Census | 1950 Census |
| GUATEMALA, the capital..... | 176,780     | 293,998     |
| San Pedro Carchá.....       | .....       | 57,389      |
| QUEZALTENANGO.....          | 30,125      | 36,209      |
| Jutiapa.....                | 6,480       | 32,894      |
| Escuintla.....              | 6,158       | 31,018      |
| Pueblo Nuevo Tiquisate..... | .....       | 30,542      |

Education is free and compulsory between the ages of 7 and 14. Illiteracy is higher than in any other Central American republic. In addition to the University of Guatemala, there are primary, secondary, professional, and special schools.

Roman Catholicism is the principal religion, but all other creeds are freely tolerated.

**Economic Life.** Agriculture is the principal industry of the republic and engages 90 per cent of the people, who either cultivate their own fields or are employed on large plantations. About one-fourth of the large holdings were operated by the government after the German plantations were expropriated in 1944. The natives grow corn, tobacco, and livestock for domestic needs. About 2,000,000 acres are under cultivation annually, with corn the largest crop. Coffee is the largest export crop, grown on plantations in the interior highlands, especially around Cobán. In the coastal regions, particularly in the Motagua Valley and around Golfa Dulce, are large banana plantations, principally the development of the United Fruit Company. Nurseries of rubber trees have been started. Beekeeping is successful on the coffee plantations, and some of the honey is exported.

The timberlands of Guatemala have not been exploited to any great extent, although lumber generally ranks fourth in value among the exports. The known varieties of lumber cover about 18,000,000 acres and include mahogany, cedar, pine, cypress, rubber, chicle, and other hardwoods. An especially rich stand of mahogany is found in Petén. With Mexico, Guatemala enjoys a monopoly of chicle, which is exported to the United States to be used for chewing gum.

Gold is found in the rivers flowing into the Atlantic, and sulfur is recovered from the volcanoes. Lead and salt are mined, and there are undeveloped sources of silver, coal, tin, copper, opals, slate, alum, antimony, marble, asbestos, and chalk. Known deposits of chrome

ore, for many years one of Guatemala's leading mineral exports, were exhausted by 1949. Exploration for oil by U.S. companies was suspended in 1949; later exploration was carried on by Guatemalans.

Most of Guatemala's manufactures are locally consumed. The country has cotton and textile mills and factories producing leather goods, furniture, soap, candles, wooden toys, matches, vegetable fats, cigarettes, rubber goods, flour, sugar, and cement. The making of hand woven textiles long has been an important industry among the Indians of Guatemala.

The commerce of the country consists largely of an exchange of raw materials for manufactured goods, with the United States taking 90 per cent of the exports. Coffee (\$37,383,000 in 1949) makes up 60-70 per cent of the exports, with bananas (\$7,584,000) ranking second, and chicle (\$1,366,000), third. Other exports include abaca, essential oils, sugar, corn, lard, gold, and lead. Imports are manufactured goods, raw materials, foodstuffs, and live animals.

An important development in Guatemala is the tourist business attracted by the year-round good climate in parts of the country, archaeological sites, the Indian civilization, and the variety of scenery. By 1947 foreign tourists were spending annually about \$600,000 in Guatemala.

Guatemala has made rapid strides in transportation in spite of the mountainous character of the land. The principal railroad, American owned, is about 700 miles in length, forming a network between cities and connecting with points in Mexico and El Salvador. The country has about 5,000 miles of highways, most of the roads being built over difficult terrain. The PAN AMERICAN HIGHWAY has been completed across the country. Steamship lines serve the principal ports, and there is a network of internal waterways which carry local produce. The chief Caribbean ports are PUERTO BARRIOS and LIVINGSTON; Pacific shipping points are SAN JOSÉ and CHAMPERICO. The Pan American Airways connects the country with the Panama Canal Zone and the United States, and the T.A.C.A. serves Central America.

**Government.** Following the October, 1944, revolution against the old dictatorial regime a new constitution was adopted in March, 1945. Legislative power is vested in a single-chamber National Assembly; the members are elected for four-year terms, and they are prohibited from serving two successive terms. The president is elected for six years and may not be re-elected until after a lapse of 12 years. A seven-member Council of State assists the president. The state is highly centralized with 22 departments, each headed by a governor appointed by the president.

Military service is compulsory between the ages of 18 and 50. The effectives in 1944 were 21,148 for the fighting services. There is also a small air force.

**History.** Guatemala was conquered in 1524 by the Spaniards. After three centuries of harsh rule independence was proclaimed on Sept. 15, 1821. The country formed a part of a Central American federation until 1839, when Rafael Carrera founded the present republic and reigned over it until his death in 1865. The radical administration of General Barrios, from 1871 to 1885, prepared the way for the civil war of 1906, which was quelled by the intervention of the United States and Mexico. On March 15, 1917, President Manuel Estrada Cabrera was inaugurated for his sixth term, but was overthrown by a revolution in 1920, instigated by the Unionist movement. Carlos Herrera was made president, and immediately began reconstructing the country. He was overthrown by the Liberals on Dec. 7, 1921, and was succeeded by General José Orellana. The country progressed under his administration, which lasted until his death in 1926. Additional advances were achieved by his successor, General Lazaro Chacon, who, however, was soon overthrown by a political group led by General Manuel Orellana. The United States then refused to





Chichicastenango, Guatemala's most colorful market place. The square in front of Santo Tomas Church is always crowded on Sunday. The Indians gather to

combine trade and religion. Though they are nominally Catholic, some cling to many pagan customs such as incense burning and witch doctors



**The Market Place** hums with conversation for it is the busiest social center of Indian life. Natives come from far and near to display their wares on mats

or under tentlike booths. There are usually about as many people buying as selling. This creates confusion and it is often difficult to walk through the crowd





**Mayans in Antigua** set up a market in the ruins of a famous cathedral which once echoed only to the quiet footsteps of black-clad monks. Guatemalans do

not consider this improper as religion is an integral part of the Indians' daily life. They converse with God as with a familiar friend



**By Burning Copal Incense**, the Guatemalan believes he is warding off evil spirits. He combines such idolatrous practices with his Christianity



**These Bulbous Clay Pots** are a specialty of a village near Chichicastenango. Each market day they are carried to town in net-covered frames



**A Guatemalan Flower Vendor** sells his tropical wares. Orchids grow wild in Guatemala where vegetation is dense and quick-growing





**Homeward Bound**, the women walk with their erect, proud carriage in spite of babies in slings, and purchases on head. Seldom do Guatemalans walk abreast.

While each village has its own characteristic dress, the women all wear loose blouses and wrap-around sarong skirts with a shawl or headdress



**Nuestra Señora de las Angustias**, a small church in Guatemala City built in 1929-41, is a mixture of baroque ornament and varied Spanish styles



Antigua was once famous for the magnificence of its churches. Now only a few mementos such as this ornate church remain after the earthquake of 1773





**Typical Unpaved Road** twists through this native village. In the remote sections, Indians live much as did their ancient Mayan ancestors



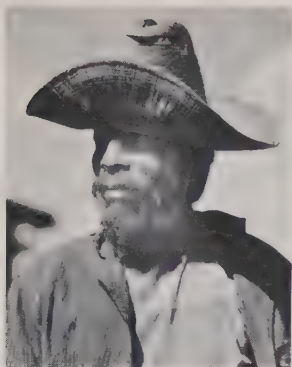
**Native Indian Textiles**—spun, dyed, and woven into intricate patterns by ancient hand methods always intrigue visitors to Guatemala



**The Friday Market** at San Francisco el Alto is crowded with Indians from mountain villages who think nothing of trudging 50 miles or more with their

produce or their wives' handcraft on their backs. Year after year the vendors display their specialty at the same spot in the market square





EWING GALLOWAY

City dweller



EWING GALLOWAY

Primitive oxcarts are common sights in Guatemala City



MIDDLE AMERICA INFO. BUR.

Village girl



PAN AMERICAN AIRWAYS

Girls fill water jugs from spring beside Lake Atitlan



EWING GALLOWAY

Guatemalan



EWING GALLOWAY

Beautiful Guatemala City recalls the charm of old Spain



EWING GALLOWAY

Indian housewife



BLACK STAR

Women do their shopping at Central Market, Guatemala City



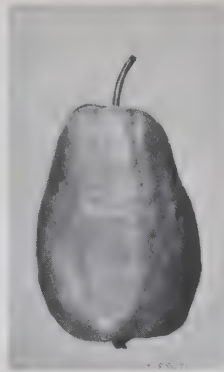
recognize the government of Orellana, who was required to resign. In February, 1931, General Jorge Ubico was elected president. In 1933 El Salvador and Guatemala settled an old boundary dispute.

Guatemala was seriously affected by the worldwide economic depression of the 1930's. Under cover of the resulting discontent President Ubico held his office and set up a rigid dictatorship. In 1935 his term was extended to 1943 by the constituent assembly. Under Ubico's dictatorship, however, the country did make many material improvements. After the United States went to war in 1941, Guatemala promptly declared war against the Axis powers on Dec. 11, 1941—following American policy as it had done in April, 1917. Ubico continued in office, his term having been extended by the constituent assembly in 1941 for a new term (1943–49), in spite of an express constitutional provision prohibiting such reelection. Nevertheless revolutionary disturbances forced him to resign on July 1, 1944. A military clique, headed by General Ponce as provisional president, then assumed control, but in October, 1944, it was overthrown by a left-wing group. The new government drew up a new constitution early in 1945 and began a program of reforms in spite of determined political opposition. Guatemala signed the Treaty of Rio de Janeiro at the Inter-American Defense Conference in 1947. In the same year the government maintained itself in power by drastic political measures. Political activities considered by the government as dangerous to public security were restricted. In the meantime the nation suspended diplomatic relations with the Dominican Republic. In 1948 the left-wing government continued its program of reform and its curtailment of civil liberties. The labor code was amended and some lands were declared subject to government expropriation. To improve the unfavorable balance of trade, the government doubled the duties on imports from nations with which Guatemala had an unfavorable trade balance. In 1950 Col. Jacobo Arbenz Guzmán was elected president by the left-wing parties; in the years following, his government came increasingly under Communist domination. Many radical social changes were adopted. Tension grew within the country and in the neighboring lands. Finally in June, 1954, Col. Carlos Castillo Armas led a revolt, and after a 12-day "war" the Arbenz regime collapsed. Castillo became provisional president, and later was elected to a five-year term. Most of the radical reforms were abolished or suspended by the new government.

G. B. DE H.; F. M. BIBLIOG.—E. Fergusson, *Guatemala* (1937); C. L. Jones, *Guatemala, Past and Present* (1940); J. Munoz and A. B. Ward, *Guatemala, Ancient and Modern* (1940); V. Kelsey and L. de J. Osborne, *Four Keys to Guatemala* (1943); R. Hancock, *The Rainbow Republics* (1947).

**GUATEMALA**, capital city, SW Guatemala, in Guatemala Department, located in a narrow valley, 4,880 feet above sea level, and about 75 miles NE of its port of San José. It is served by the Pan American Airways and has railroad connection with San José, Puerto Barrios, San Salvador, and with Mexico through Ayutla. Guatemala is the most important manufacturing center of the country and a market for fruits, grains, and other agricultural products grown in the surrounding valleys. Coffee is the chief export. The city was founded in 1776 after the earlier capital, Guatemala Antigua, was destroyed by an earthquake in 1773. After a series of earthquakes destroyed the city in 1917–18, it was entirely rebuilt on the same site. Pop. (1950) 293,998.

**GUAVA**, any of several species of trees or shrubs belonging to the genus *Psidium*, native to tropical America but widely cultivated in other warm regions, including California and Florida. The common guava, *P. guajava*, highly valued for its fruit, which is eaten raw or made into jellies and jams, is a tree about 30 feet high having smooth, greenish-brown bark, light green leaves, and white flowers with incurved



U. OF FLORIDA  
Guava

petals. The yellow fruit is round or pear shaped, one to four inches thick, and has fleshy pulp which varies in color from white to pink. It has a musky aroma, and is sweet or mildly acid when ripe. The strawberry or Cat-tley guava, *P. cattleianum*, grown extensively in California for its fruit, is an arborescent shrub sometimes 20 feet high with thick, leathery leaves. The fruit is almost two inches thick and resembles the strawberry in shape. Culture, by seed or vegetative methods, is relatively simple, major requirements being suitable temperatures and adequate soil drainage. The pineapple guava, *Feijoa sellowiana*, is not a true guava, despite its similarity in growth habits and fruit. M. R. K.

**GUAVIARE RIVER**, Colombia, rises in the Andes, near Bogotá, and flows E for over 700 miles to join the ORINOCO. It is navigable for small vessels for 600 miles.

**GUAYAMA**, town, SE Puerto Rico, department of Guayama, about four miles NE of the harbor of Jobos with which it is connected by railroad. Guayama is in a cane-growing district and has sugar manufactures. Pop. (1950) 19,408.

**GUAYAQUIL**, port and largest city, Ecuador, capital of Guayas Province, situated on the Guayas River, 30 miles above the point where it empties into the Gulf of Guayaquil, 74 miles from the Pacific Ocean, and about 280 miles by rail SW of Quito. The city is served by the Pan American-Grace Airways. Laid out along the river at the foot of a hill, Guayaquil is famous for its acres of cacao beans which are spread out to dry six to eight inches deep across half the width of the pavements. There is a busy river traffic and exports of fruit, coffee, cotton, straw hats, petroleum, and tropical woods. The first settlement was made by the Spaniard Benalcazar early in the 16th century. Indian rebellions and raids by English pirates are part of the early history until an uprising of the people in 1820 won the city's freedom from Spain. Once shunned as a plague spot, the city was made clean and healthful after a vigorous campaign to stamp out yellow fever was waged by the Rockefeller Foundation under the leadership of William Gorgas. Guayaquil was the center of political unrest in Ecuador in 1947. Pop. (1950) 258,966.

**GUAYAQUIL, GULF OF**, an inlet of the Pacific Ocean, in Ecuador, the only important break on the W coast of South America N of Chile. There are two entrances—one on each side of the island of Puná.

**GUAYAS RIVER**, Ecuador, rises in the Andes and flows SW for about 200 miles to the Gulf of Guayaquil. It is the highroad for the commerce of Guayaquil, being navigable for small vessels to that city.

**GUAYCURU**. See GUAICURUAN LINGUISTIC FAMILY.

**GUAYMAS**, seaport on one of the best harbors in W Mexico, in the state of Sonora, on the Gulf of California. This delightful old city has an attractive setting on a landlocked bay, from which are shipped silver ore and sulfate, gold, and hides. Pop. (1940) 8,796.

**GUAYRA**. See LA GUAIRA.

**GUAYRA FALLS**, Brazil and Paraguay, on the Paraná River, a series of 18 picturesque cataracts which drop 374 feet in about three miles. The largest of the cataracts is Sete Quedas, "Seven Cataracts," hidden in wild jungle-covered hills. Although the falls are among the world's natural wonders, comparatively few people have seen them because of their inaccessibility.



**GUAYULE** is a rubber-bearing plant native to north central Mexico and adjacent Texas. Characteristically guayule, *Parthenium argentatum* Gray, grows on limestone soils at an altitude of 3,000–7,000 feet and where the rainfall averages 10–15 inches per year. The plant is a much-branched, woody shrub with silver gray leaves that give it a dusty appearance. The flowers are yellow, small, and inconspicuous. Wild plants are generally about two feet in height and have a dry weight of one or two pounds after several years'



CHICAGO NAT. HIST. MUS.

**Guayule plant**

CHICAGO NATURAL HISTORY MUSEUM

**Rows of cultivated guayule growing on a plantation**

growth. Hardy perennials in habit, undisturbed plants probably live for 30 to 40 years. They have great capacity to withstand long, continued droughts.

The rubber of guayule is a constituent of latex, which is found, not as in most other rubber-bearing plants, in specialized latex vessels, but in simple parenchyma cells of the woody tissues. Rubber is stored in all parts of the plant, with the possible exception of the leaves. In wild plants the rubber content is usually about 7 per cent of the total dry weight at maturity; selected plants grown in cultivation contain as high as 22 per cent rubber. Maximum rubber content is reached at an age of 4–10 years, depending upon growing conditions. The Germans began experimenting with the extraction of guayule rubber before 1900. In 1904 a processing factory, using a pebble-mill extraction process, was set up at Torreón, Coahuila, Mexico. Construction of other factories followed and production of rubber from wild guayule has been almost continuous except during periods of very low rubber prices.

Wild stands of the plant are usually sparse and limited, and generally rather inaccessible. In both Mexico and the United States there have been attempts to cultivate the plant in order to increase rubber production and lower costs. To provide a domestic source of natural rubber during World War II the U.S. Department of Agriculture between 1942 and 1944 planted 36,000 acres of guayule in California, Arizona, New Mexico, and Texas. Guayule rubber as extracted from the plant is a highly resinous product but is acceptable in quality and has many commercial uses. For special purposes the rubber is desinated.

W. G. WHALEY

**GUBBIO**, ancient Umbrian *Iguvium*, Roman *Euguvium*, picturesque hillside city and bishop's see, central Italy, Umbria Division, Perugia Province; 23 miles NE of Perugia, 70 miles SE of Arezzo. It is built on the slopes of Monte Calvo (1,740 ft.) and Monte Ingino and has many noteworthy examples of medieval architecture. The most imposing of these is the Gothic Palazzo dei Consoli, now used as a municipal building. The 12th-century cathedral has paintings of the Umbrian school, which flourished in the 14th and 15th centuries; a remarkable carved episcopal throne and other beautiful wood-carvings; and a fine collection of ruby-luster majolica, for which the town has been famous since the 16th century. The Palazzo

Ducale (1474) was the stronghold of the Urbino dukes. Gubbio is historically important for the discovery here in 1444 of the seven brass Eugubine (Iguvine) Tablets (now in the civic museum) which were engraved in the first or second century and provide a key to early languages of Italy. Gubbio is the birthplace of the miniature painter Oderisio. Pop. (1949 est.) 8,500.

**GUBEN**, Polish **Gubin**, town, Poland, in the province of Poznań, at the confluence of the Neisse and

Lubst rivers, 30 miles by rail SE of Frankfurt an der Oder, Germany. Features of interest in the town include the Gothic town church (16th century) and the renovated (1672) town hall. Its manufactures include paper, men's hats, cloth, machinery, and wine. Truck farming and the mining of lignite are important. Guben, of Wendish origin, was founded about 1200 and attained civic rights in 1235. It passed into the possession of the margrave of Brandenburg early in the 14th century; and Bohemia in 1368; and, with the remainder of Lower Lusatia, Prussia in 1815. It came under Polish administration in August, 1945. Pop. (1946) 3,040.

**GUDBRANDSDALEN**, a valley of the upper Laagen River, S central Norway, in Opland County, connected to the W coast of Norway through Kringen Valley in Romsdal County. A geographically natural way of travel across Norway since the days of the Vikings, the valley is now crossed by rail and motor roads. Beginning at Lake Lesjaverk in the western mountains, Gudbrandsdalen cuts southeast across Dovre Fjeld and the central plateau, through rugged, snowcapped mountain scenery, fertile agricultural slopes, and timber districts, to Lake Mjøsa, a distance of 140 miles. Dairying and the raising of grain and the famed Gudbrandsdal horses are the principal industries. Lillehammer, the chief city of the region, is linked by rail and highway to Oslo and Trondheim. Most of the families in the valley, who trace descent from Norse nobles of the saga days, retain their peculiar dialect and customs. Medieval wooden churches with carved dragon-head gables, and a number of 11th-century carved wooden farmhouses can still be seen. During World War II the valley was occupied by the Germans from April, 1940, until May, 1945.

**GUDENAA RIVER**, most important river of Denmark, in Jutland, rises near the E coast of Jutland, crosses Lake Silkeborg and flows NE through Aarhus, Viborg, and Randers counties to empty into the Kattegat via Randers Fjord. Its length is about 88 miles. Salmon are found in its lower stretches.

**GUDERIAN**, **HEINZ**, 1888–1954, German Nazi officer, was born in Kulm, West Prussia (now Chelmo, Poland), and trained in a military school. Serving as a staff officer in World War I and with the ministry of war in 1919, he became a tank expert. Because his country was forbidden tanks by the Versailles Treaty,



he experimented with new tank models and trained tank experts and technicians in hidden German bases inside Soviet Russia, ostensibly for the instruction of the Russian army. When Hitler came into power, Guderian formed motorized units and commanded all Germany's tank troops (1935). After his defeat at Moscow (1941), he reorganized the armored forces and later became army chief of staff. A colonel general, he was reported ousted from his command on the Russian front shortly before his capture by U.S. troops in 1945. In 1950, U.S. military officials were studying a plan by Guderian for a new type of U.S. General staff. He wrote *Panzer Leader* (1952).

**GUDGEON**, in Europe a cyprinoid fish related to the barbel; in the United States, the name for certain varieties of minnow. See **BARBEL**; **MINNOW**.

**GUDRUN** or **KUDRUN**, old German epic, embodies the legends of the North Sea shores among the Hegalings (Frisians).

**GUELDER-ROSE**. See **SNOWBALL**.

**GULDERS**. See **GELDERLAND**.

**GUELPH** AND **Ghibelline**, factions whose struggle was a notable feature of medieval Italian life. The names were derived from those of German princely families, Welf and Waiblingen, rivals in the early twelfth century for the title of Holy Roman emperor. The Welf line, dukes in Bavaria and Saxony, included the emperor Otto IV; from it descended rulers of Saxony, Brunswick, and Hanover and the house of Hanover in Great Britain (see **HANOVER**, **HOUSE OF**; **BRUNSWICK**, **HOUSE OF**). The Waiblingen, also known as the Hohenstaufen or Swabian line, included the emperors Frederick Barbarossa, Henry IV, Philip of Swabia, and Frederick II (see **HOHENSTAUFEN**; **GERMANY**, **History**).

In Italy, especially during and after the reign of Frederick Barbarossa, the parties became associated not only with the conflict between pope and emperor, but also with that between some north Italian cities and the Hohenstaufen emperors. Other cities out of rivalry joined on the side of the emperors. The Guelph cities formed a league, which was generally allied with the papacy, and in the long struggle maintained their independence, though at the cost of persistent warfare and internal strife.

With the defeat of Frederick II's sons, Conrad IV in 1254 and Manfred in 1266, the Hohenstaufen line and cause died out, although the Ghibelline party continued in many Italian cities. By the thirteenth and fourteenth centuries, however, both Guelph and Ghibelline were names for parties that frequently had little relation to their historic origin or to political principle, but which were involved in struggles for power between cities or between families and groups within cities. Party loyalty was often inherited. There were changes of allegiance from one party to the other as well as divisions within the parties—as that in Florence between the Blacks and Whites, both Guelph, which led to the banishment of Dante (see **DANTE ALIGHIERI**; **FLORENCE**, **History**). The party names were virtually banned in many cities, and the parties themselves died out.

**GUELPH**, city, Canada, S Ontario, county town of Wellington County, on the Speed River and the Canadian Pacific and the Canadian National railways; about 45 miles WSW of Toronto. Guelph was founded in 1827 by John Galt, commissioner of the Canada Company, and named by him for the royal family. Guelph is the seat of the Ontario Agricultural College and the Ontario Veterinary College. Located in a rich farming district, it has become an important manufacturing center, producing soap, hardware, agricultural implements, furniture, clothing, shoes, cotton yarns, medical supplies, flour, and furnaces. Pop. (1951) 27,386.

**GUERICKE, OTTO VON**, 1602–86, German physicist, was born in Magdeburg, of which place he was burgomaster from 1646 to 1681. He made notable discoveries on the nature of air and electricity, also

in astronomy, the chief of which are found in his *Experimenta nova* (1672). He invented the air pump (1654) and made a crude barometer and a friction-type machine for generating static electricity. He also demonstrated the pressure of the air with his invention known as the Magdeburg hemispheres. When these hemispherical cups were fitted together and a vacuum was formed by withdrawing the air from their interior with an air pump, two teams, of four horses each, were unable to pull them apart. Von Guericke described the siege of Magdeburg during the Thirty Years' War in a work entitled *Geschichte der Belagerung und Eroberung von Magdeburg* (1631). See **VACUUM**; **ELECTROSTATICS**, *Electrostatic Machines*.

**GUÉRIN, PIERRE NARCISSE, BARON**, 1774–1833, French artist, was born in Paris. He studied under Regnault, and also came under the influence of David. In 1814 he was appointed professor of painting at the Fine Arts School in Paris, and in 1822 director of the French school at Rome, where he died. He was an officer of the Legion of Honor. Guérin gained his first success with "The Return of Marcus Sexton" (1800), and followed it up by "Phedra Accusing Hippolytus" (1802). Still drawing inspiration from the antique and from tragic motives, he painted "Orpheus at the Tomb of Eurydice," "Andromache" (1810), "Bonaparte Pardoning the Rebels at Cairo" (1810), "Clytemnestra" (1816), "Aeneas and Dido" (1817).

**GUERNICA**, Basque Gernika, town, Spain, in the province of Vizcaya. Considered the holy city of the Basques, Guernica was the scene, in the Middle Ages, of the meeting of Basque *juntas* (estates) under an oak tree where Ferdinand and Isabella had taken a solemn oath to maintain the ancient liberties of their land. During the Spanish Civil War, though Guernica had no military installations, the town was the target of a deliberate German air attack (Apr. 26, 1937) which made military history. It was the first time that an "air blitz" was directed at a defenseless civilian population. During the busiest market time the Germans attacked the town with incendiary bombs for two and a half hours and completely destroyed it, except for the sacred oak, which survived undamaged. The number of dead was not published. The Germans first denied but later cynically admitted what opened a new epoch of warfare equal in importance to the first tank battle of Cambrai (1917). Guernica was a rehearsal for the destruction of Rotterdam and Coventry (see **COVENTRY**; **ROTTERDAM**). Picasso perpetuated the memory of the destruction in one of his most famous paintings (see **PICASSO, PABLO**). Pop. 1900.

**BIBLIOG.**—G. L. Steer, *The Tree of Gernika, A Field Study of Modern War* (1938).

**GUERNSEY**, second largest and westernmost of the Channel Islands, in the English Channel 70 miles S of Dorsetshire, England, and 30 miles from France's W coast; area 24.5 sq. miles; population 43,546. Its highest point reaches only 350 feet above sea level. The fertile soil, more than 50 per cent of which is farmed, yields many varieties of fruit, melons, vegetables, and flowers. Large quantities of these and the island's chief crop, tomatoes, are exported weekly to English and Continental markets. Guernsey is famed for its fine cattle, "Golden Guernsey," which are much in demand for dairies all over the world. Most of the island's dairy products also go to England, and a variety of blue granite quarried here is widely used in England and France. St. Peter Port, on the east coast, is the chief town. Victor Hugo lived at St. Peter Port during his exile from France and here wrote *Les Misérables*, *The Man Who Laughed*, and *Toilers of the Sea*. The Gothic church of St. Peter Port is a notable example of medieval architecture.

Administratively the near-by islands of Alderney, Sark, Herm, and Jethou belong to Guernsey. Norman French has always been spoken here, but, in September, 1946, Guernsey became the first of the Channel Islands to adopt English as its official language.



During World War II, following France's fall and a severe bombing of St. Peter Port's docks, the Guernsey group surrendered on June 30, 1940, to German forces. Most of the English civilians and the military garrison and the best of the dairy herds and their registration records had been evacuated. Five years later, on May 9, 1945, after total German collapse, British troops returned to liberate the islands and re-establish English rule.

**GUERNSEY CATTLE.** See **CATTLE**.

**GUERNSEY LILY**, a species of South African bulbous plants of the *Amaryllis* family, *Amaryllidaceae*, cultivated for autumn bloom. The flowers of the Guernsey lily, *Nerine sarniensis*, are funnel formed and in shades of red. Leaves are strap-shaped and appear after the flowers.

**GUERRERO, VICENTE**, 1782–1831, Mexican revolutionist, was born in Tixtla. He joined the patriot army under Morelos in 1810, and kept up his resistance until 1821, when he joined Iturbide, but rebelled again when Iturbide proclaimed himself emperor. In 1823–24 he was a member of the executive junta. He opposed the seating of President-elect Pedraza on the ground that the election had been fraudulent, and had himself elected by Congress (1829), but was obliged to abdicate, and was finally captured and shot. During his administration a decree was passed abolishing slavery.

**GUERRERO**, state, SW Mexico, bordered on the S and SW by the Pacific and enclosed on the NW, N, and E by the states of Michoacan, Mexico, Morelos, Puebla, Oaxaca; area 24,885 sq. mi.; pop. (1950) 917,719. It is crossed by the Sierra Madre del Sur. The Río de las Balsas (Río Mexcala) is the only important river. The state is mountainous and fertile, yielding grain, coffee, tobacco, fruits, cotton, and sugar. It is exceedingly rich in minerals, gold, silver, petroleum, lead, copper, opals, topazes, and coal, but the deposits have not been developed. The inhabitants are mainly Indians. Chilpancingo is the capital; ACAPULCO is the seaport.

**GUERRILLA WARFARE**, literally, "little war," from the Spanish diminutive *guerra*, meaning war, and first applied during the warfare of the Spanish people against Napoleon. It is often called the "people's war." Guerrilla warfare is carried on by loosely organized bands, sometimes without official sanction, and sometimes degenerates into warfare for plunder and banditry.

Guerrilla fighting has characterized almost all American warfare. In the Revolution the people's war was based largely on the militia system, which won such victories as Lexington and Saratoga. Partisan bands, such as those led by Marion, Sumter, and Pickens, had official recognition. The Green Mountain Boys who took Ticonderoga under Ethan Allen and won Bennington under Stark were irregular fighters who eventually formed their own government in the state of Vermont. The "Cowboys" and "Skinners" of New York were undisciplined bands that often turned to murder and promiscuous plundering. In the Civil War, Quantrill's guerrilla band developed out of the prewar Kansas troubles and gave training to such later bandits as Jesse and Frank James and the Younger Brothers. Mosby's Rangers in Virginia were more typical. His men used no uniforms or disguised themselves in Union uniforms, both capital offenses under the laws of war. In the Spanish-American War the United States made use of Cuban guerrillas; and in the Philippines the insurrectos carried on guerrilla warfare for two years after the armies in the field were defeated by American forces.

Garibaldi's fighting in Italy was of guerrilla character, as was the less successful franc-tireur movement in the Franco-Prussian War. The Boer War followed the same course as the contemporary Philippine insurrection; the work of the Boer commandos after the defeat of the main armies furnished the inspiration for British amphibious raiders in World War II. World

War I developed one of the greatest leaders of irregular warfare, Col. T. E. Lawrence, who led Arab bands in typical guerrilla warfare.

Spain, in the Civil War of 1936–38, was again the scene of a guerrilla type of fighting, on the part of the Nationalists. During World War II guerrilla modes of warfare were found to be still effective. China's war against Japan was largely a people's war. The rival bands of Marshal Tito and Draja Mihailovic in Yugoslavia brought charges of traffic with the enemy and banditry characteristic of guerrilla activities. Similar rivalries developed in Greece and in Poland. The French Forces of the Interior rendered valuable service in the liberation of their homeland. After World War II guerrillas played important roles in Communist victories in China and Indochina. At the same time Communist irregulars were active in many other lands, especially Greece, Indonesia, Malaya, and the Philippines.

**GUERTIN LAWS.** See **INSURANCE**, Life Insurance, *Mortality Tables*.

**GUESCLIN, BERTRAND DU.** See **DU GUESCLIN**.

**GUESS, GEORGE.** See **SEQUOYAH**.

**GUEST, EDGAR A.**, 1881– , American poet, was born in Birmingham, England. He came to the United States with his family in 1891 and was educated in the public schools of Detroit. In 1895 he began working for the *Detroit Free Press*, first as an office boy and cub reporter and later as a feature writer and columnist. His folksy, inspirational verse, contributed to his daily column, "Just Folks," has been collected in such volumes as *Home Rhymes* (1909), *Just Glad Things* (1911), *A Heap o' Livin'* (1916), *Just Folks* (1917), *Life's Highway* (1933), *All in a Lifetime* (1938), *Living the Years* (1949).

**GUETTARDA**, a genus of ornamental tropical shrubs and trees of the family *Rubiaceae*. The species *Guettarda speciosa* is common along the shores of the South Pacific and grows as a shrub or tree, with tubular white, showy flowers and large leaves. The small orange brown fruit is said to be edible. There are 40 to 50 species included in the genus.

**GUEUX, LES, or BEGGARS OF THE SEA**, the appellation of certain of the patriot party of the Netherlands in their struggle against Spain in the 16th century. The name was adopted as an honorable one from a term of abuse flung at them in the presence of the regent, Margaret of Parma, in 1566, after they had protested against the introduction of the Inquisition into the Netherlands. One body of the Gueux, who became known as the Beggars of the Sea, fitted out privateers, and under the leadership of Count de la Marck, harassed Alva's communications, and by their capture of Brill (1572) they won the first success in the struggle which eventually resulted in the independence of the Netherlands.

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**GUGGENHEIM, DANIEL**, 1856–1930, American capitalist and philanthropist, son of MEYER GUGGENHEIM, was born in Philadelphia, Pa. Stressing technological and engineering advances and centralized control over all phases of mining and processing, Guggenheim directed the expansion of the American Smelting and Refining Company over three continents. Though favoring comprehensive social legislation and what he termed industrial democracy, including profit sharing, he did not institute such democracy in his own plants and insisted on the open shop and individual bargaining. He established the Daniel and Florence Guggenheim Foundation (1924), the school of aeronautics at New York University (1925), and the Daniel Guggenheim Foundation for the Promotion of Aeronautics (1926). His charities were extensive and often anonymous.

**GUGGENHEIM, MEYER**, 1828–1905, American capitalist, was born in Langnau, Switzerland, and came to Philadelphia at the age of 19. His purchase



of a copper mine (1887) was the beginning of his large metallurgical empire. He greatly increased his profit through ore processing, building several smelters and a refinery, and later established an exploration company to insure control of ores at their source. Instrumental in the success of the business were his seven sons.

**GUGGENHEIM, SIMON**, 1867–1941, American legislator, son of MEYER GUGGENHEIM, was born in Philadelphia, Pa. He was educated at public schools and studied in Europe, later engaging in the mining and smelting industry in the United States and Mexico. He lived for a time in Pueblo, later going to Denver, Colo. In 1907 he was elected to the U.S. Senate, serving until 1913. With his wife he established, in 1925, the John Simon Guggenheim Memorial Foundation in memory of his son, to subsidize advanced study for those engaged in scientific or cultural projects.



GUGGENHEIM FOUNDATION  
Simon Guggenheim

**GUGGENHEIM FOUNDATION**, or more fully, the John Simon Guggenheim Memorial Foundation, was established in 1925 by Simon and Olga Guggenheim in memory of their son, John Simon, who died in 1922. The initial endowment was \$3 million. The main purpose of the foundation is "to promote the advancement and diffusion of knowledge and understanding and the appreciation of beauty" by aiding scholars, scientists, composers, artists, and writers. The fellowships, which are international in scope, are given each year to those who have shown capacity for original research and artistic creation. There are no distinctions as to sex, race, or creed. Appointments are made for one-year periods, but in exceptional cases extensions are given. Individual grants generally amount to about \$3,000 a year. In 1955, 273 scholarships totaling \$1,059,500 were given, making a grand total of 3,424 awards amounting to \$9,799,500 given since the foundation was established.

**GUIANA**. See BRITISH GUIANA; FRENCH GUIANA; SURINAM.

**GUIDANCE, PSYCHOLOGICAL**. See PSYCHOLOGICAL GUIDANCE.

**GUIDED MISSILE**, a jet-propelled projectile whose path is controlled during flight. (See JET PROPULSION; PROJECTILE.) The types of control may be classed as internal (or inertial), external, and homing.

#### CONTROL MECHANISMS

**Internally Controlled Missiles**. An internally controlled guided missile contains all of the instruments and mechanisms required to insure adherence of the projectile to a predetermined flight path. Examples of this type are the World War II German V-1 with its American copies the U.S. army JB-2 and the U.S. navy Loon, and the German V-2 (see ROCKET). These are jet propelled pilotless aircraft having control mechanisms similar in basic principles to those of the conventional automatic pilot (see AERONAUTICS, The Modern Airplane, *Automatic Pilot*). In operation, desired altitude and course are preset, the missile is launched via catapult or JATO (jet assisted take-off), and the automatic pilot assumes control, maintaining the plane on proper course and at correct altitude. The missile can be made to dive at a predetermined range, before the fuel supply is exhausted, by the use of a time clock that is so connected to the control mechanism that it will change the setting on the automatic pilot and regulate the required dive angle. If desired, fuel flow may be turned off by the same time clock attachment.

Missiles having internal controls are particularly susceptible to external disturbing influences such as

atmospheric conditions; therefore adequate allowances must be made in calculating instrument setting of the missiles. Furthermore, the tactical effectiveness of internally controlled missiles is limited because setting errors and instrument errors cannot be corrected after launching.

**Externally Controlled Missiles**. An externally controlled missile follows a desired path to its objective in response to signals from some outside agency. To be truly guided, a missile must be capable of changing its course to compensate for any external disturbing influences and for such unpredictable factors as evasive target maneuvering.

The German X-4 is an example of the externally controlled missile. This was a primitive mechanism, being one of the first attempts at guiding a projectile by external means. The X-4 was an air to air rocket, controlled from its launching plane by long wires. Subsequent improvements of the X-4 produced models that were controlled from the parent aircraft by radio. The German A-4 (V-2) was often guided in azimuth by a radio beam pointed in the designated direction (see AZIMUTH). Radio receivers in the rocket regulated the control surfaces through servo-mechanisms that caused the missile to course down the middle of a guiding radio beam. In a large number of missiles, such as those of the Azon class, radio control consisted of command signals dispatched by human operators who were stationed on the ground or in control aircraft.

One of the first U.S. guided missiles to enter combat in World War II was the Azon, which was a standard 1000 pound bomb fitted with a special tail assembly containing radio controlled fins, a gyroscope for stabilization of roll, and a flare. The name was derived from the method of control, which was in azimuth only. Tactically, the Azon was released like any ordinary aerial bomb, then was made to move to left or right by radio signals sent by the bombardier stationed in a launching aircraft. The bombardier, while observing his target, was guided in his control of missile direction by the flare contained in the Azon, and he was able to synchronize the missile trajectory with a specific target site. Because of the accurate, pinpoint-directional control that was possible with the Azon, it was particularly effective against long narrow targets; consequently it was used frequently and successfully in 1944 and 1945 in the bombing of roads in the Burma theater.

It soon became apparent that the highly specialized aircraft and crews charged with the mission of launching Azon missiles must be kept out of visual range of well defended target areas. The only way to accomplish this was to revise the Azon in such fashion that the missile could be launched from some point outside the defense perimeter of a target area and still proceed directly to the objective. An improved Azon missile was produced and named the Razon, in which all four tail fins were made mobile through radio control operated by the bombardier. The Razon had a special nose mechanism that contained a television scanner and transmitter. After dropping the projectile, the bombardier could observe the screen of a television receiver located in his plane; then, on the basis of his observations of both the missile trajectory and the target, he was able to adjust the Razon trajectory by radio control. Launching aircraft had only to be within specific radio distance of the missile, not necessarily within visual distance and antiaircraft artillery range of the target area. With further improvement the Razon gave rise to the Roc, and both missiles were used by U.S. forces in Korea.

These first externally controlled missiles were little more than specialized bombs that derived little or no lift from the air. In addition to Razon and Roc, there is a whole family of winged guided missiles, some of which are gliders and some jet propelled. All of these, although similar in fundamental design and operating principles, differ in respect to size, weight,



range, wingspan, pay load capacity, and methods of launching. This class of missiles may be guided by visual observation or by information relayed from television equipment in the missile itself. Examples of the winged missiles are the Gorgon, which is launched from a mother plane, uses television and is guided to its target by radio control; the Glomb, a glide bomb, which is towed to the target area by a plane and, when released, is guided in a manner similar to that in Gorgon; the Gargoyle, which is launched from a parent plane, powered to the target by JATO, and guided by radio and which involves visual target observation aided by a flare contained in the missile. All these missiles had reached the test stage by the end of World War II.

Later improvements introduced the use of electronic impulses from an outside control station to direct missiles to their respective targets. The Nike, for example, is a ground to air missile controlled by a ground installation that tracks both target and missile by means of radar and automatically computes the proper collision course, or the course followed by the projectile that leads to the exact point where the Nike meets its target, presumably an enemy craft. Another variation in external missile control is seen in the beam rider, in which controls automatically maintain the projectile on an electronic path leading from a ground radar station to a selected swift-moving target. See RADAR.

**Homing Missiles.** In homing systems, the missile is inexorably drawn to the target by heat, light rays, or some similar fatal identification that is unwittingly given off by the target itself. By the end of World War II numerous investigations were sponsored in the development of homing devices. A heat-sensitive element was designed to detect any heat producing target, such as a factory, a power plant, or a steam vessel, and when installed in a guided missile such an element led the weapon unerringly to any heat producing objective. Similarly, an element sensitive to light rays was produced and successfully guided projectiles to any given source of light. The navy Sidewinder is an example of a U.S. missile that is guided by an infrared (heat) homing system.

The Japanese in World War II had a simple homing device, the Baka bomb, which was a small glider assisted by rocket propulsion units and launched

from a parent aircraft. The control and target seeking mechanism was the pilot himself, who was blown up with his weapon when the objective was reached.

A more modern example of an efficient homing missile is the U.S. navy Bat, a small glider that can be launched from a medium or heavy bomber. It carries a radar transmitter and receiver, and radar echoes from the target guide the missile toward the echo source. The Bat contains many of the fundamental engineering principles incorporated in later design.

**Future Control Possibilities.** A celestial guide system, under which a long-range missile would guide itself by reference to the stars, showed great promise. Development of such a system appeared to be based on the use of automatic telescopes through which the stars would be observed; data thus received would be directed to computers carried by the missile.

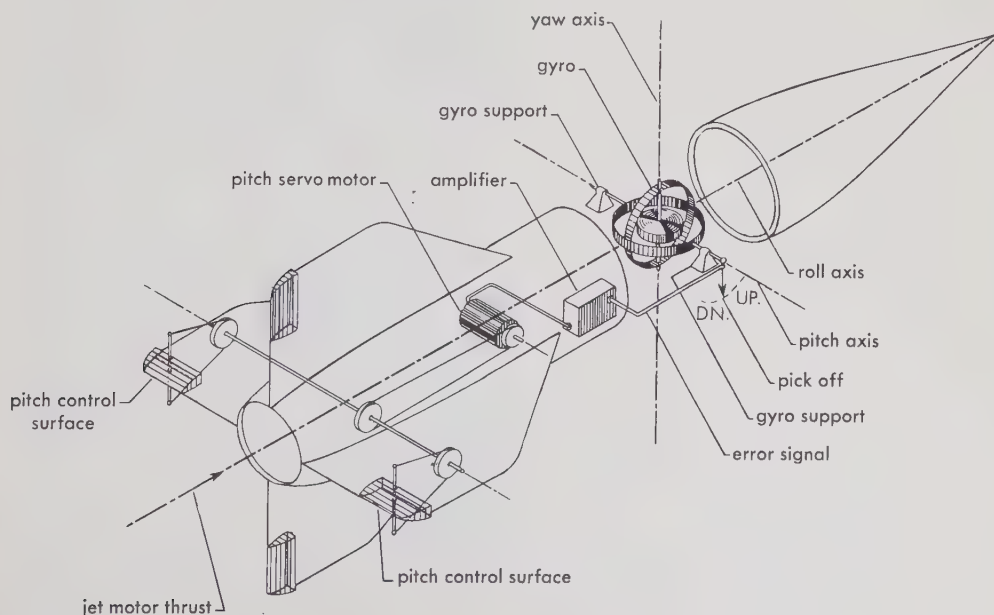
#### TYPES OF GUIDED MISSILES

Guided missiles are ordinarily classified as air to surface, surface to air, air to air, and surface to surface.

**Air to Surface Missiles, ASM.** There are three classes of air to surface missiles: the controlled bomb, the glide bomb, and the powered missile.

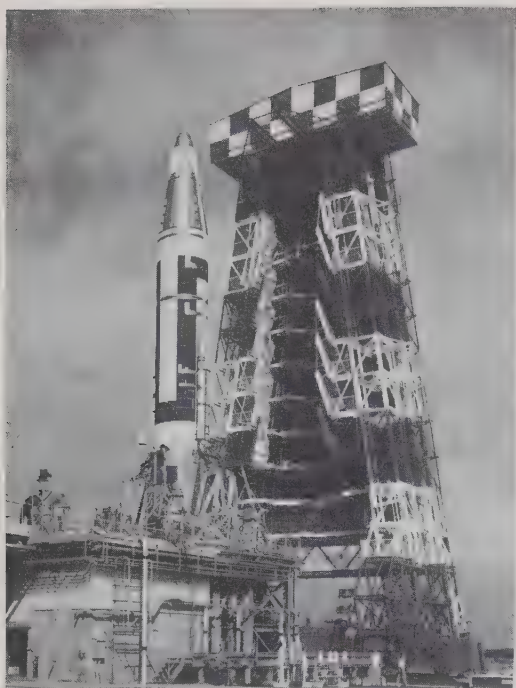
In the *controlled bomb* the ballistic trajectory can be varied for greater accuracy by remote control or by some special target-seeking device. Almost absolute bombing efficiency is assured with a control bomb missile because the launching craft is able to fly at altitudes high enough to evade detection and destruction, and it can fly at such maximum speeds as would make conventional bombing impossible. Control mechanisms within the missile eliminate errors in computation caused by external disturbing factors. Such errors were not uncommon in World War II bombing operations even when all trajectory data was known, and even when the plane was equipped with a near perfect bombsight. Atmospheric conditions, the possible erratic flight path of an attacking plane caused by antiaircraft detonations in mid-air, and other error inducing factors often led to poor bombing results.

The *glide bomb* is equipped with wings to increase bomb range and to lessen exposure of the launching aircraft to antiaircraft artillery fire.



Guidance system of a typical guided missile





Prior to launching this air force Atlas ICBM, a workhorse of the U.S. space program, the gantry tower used to ready the giant missile is rolled away

The *powered missile* is the ultimate in air to surface guided missiles. It has its own propulsion system and can fly a considerable distance after being launched. Air to surface missiles are especially effective against targets that are well distinguished from their backgrounds; ships and bridges, for example, are excellent targets for the powered missile as are large power plants, oil tanks, and dams.

**Surface to Air Missiles, SAM,** are integral parts of the anti-aircraft defense plans of the United States, Canada, and, presumably, all of the major world powers. These weapons are powered by rockets if they are designed to travel relatively short distances, and by ram jets if they are to fly longer distances. The U.S. army Nike is an example of SAM. The Nike is a 1 ton anti-aircraft missile with a 25 mile range and a speed of 1300 miles per hour. A variation of the Nike was the navy Terrier type missile, with essentially the same specifications as the Nike but with certain special modifications that allow launching from a moving ship.

Some of the later surface to air missiles include the army Nike-Ajax, having a range of 25 miles and designed particularly for the defense of large cities; the Nike-Hercules, a longer-range version of the Nike-Ajax, has a 50 mile range. The air force Bomarc, an area anti-aircraft defense weapon, can travel 200 miles. The navy Terrier I, an anti-aircraft missile with a 10 mile range, and the Terrier II, a larger, ship-based missile with a 20 mile range, are added examples, as is the navy Talos, a long-range anti-aircraft missile.

**Air to Air Missiles, AAM,** are guided missiles launched as weapons by one aircraft and aimed at an adversary aircraft in flight.

In modern air warfare, with planes traveling at supersonic speeds, gunnery is outmoded. Yet fighting aircraft must be armed, and the only logical substitute for, or adjunct to, conventional armament is the air to air guided missile. Many technical problems must be solved, however, before air to air missiles can favorably compare with the efficiency of other

guided projectiles. First, the size and weight of air to air missiles must necessarily be limited because speedy modern military aircraft are not designed to carry heavy loads. Second, missiles can be launched from an aircraft effectively in only one direction—forward—because the plane's slipstream will alter the course of any projectile that might be launched laterally or from the rear of the plane. Third, absolute accuracy is mandatory in the firing of any weapon at modern fighting jet planes. The speed at which aircraft travel is a major source of difficulty in timing the target and, in addition, modern planes are necessarily so rugged in construction that near direct hits are necessary for their destruction. Finally, the pilot of an interceptor plane must still find the enemy and close on the target before any attack can be made. Even with the aid of radar, this is a difficult undertaking in any supersonic operation.

Air to air missiles, however, are in considerable production. They are standard equipment of all flying arms and represent tremendous fire power. The navy Mighty Mouse missile, for example, has an explosive charge greater than that of any anti-aircraft artillery shell. In addition, the navy has the Sidewinder, an advanced model; the Sparrow I and its successor, Sparrow II; and the Sparrow III, the most advanced of this missile series.

**Surface to Surface Missiles, SSM,** are guided projectiles launched from a surface site and directed to a specific surface target area. The international ballistic missile falls into this category as do all of the superartillery type projectiles, which have ranges varying between 8 and 200 miles. For example, the army Redstone long-range rocket has a range of 200 miles; the Corporal, 100 miles; the artillery rocket LaCrosse, 8 miles. The LaCrosse is 19 feet long, and the Dart, a short-range missile, is only 5 feet in length. Such comparatively short lengths of the weapons make for excellent mobility of launching devices, such as the specially designed truck that transports and acts as launching platform for the LaCrosse.



On July 23, 1958, at Cape Canaveral, Fla., the U.S. air force launched Thor-Able III containing a white mouse whose reactions to outer space were tested



The intercontinental ballistic missile (ICBM) is a surface to surface missile that may carry a nuclear warhead and is capable of being fired from one continent and striking a target 5000 miles or more distant on another continent. The ICBM may be likened to an unmanned superbomber that can hit its objective with deadly accuracy and power. In June 1957 the air force tested the Atlas, the first U.S. ICBM, and late in the following year had successfully flight-tested such a missile over a range of 5500 nautical miles.

Concurrent with the development of the ICBM was that of the intermediate range ballistic missile (IRBM), which accurately reached targets within a range of 1500 miles. Two such U.S. missiles to reach the operational stage during 1958 were the Thor (air force) and Jupiter (army) IRBMs. These missiles were developed for use at U.S. bases overseas and for delivery to the NATO nations. Tests were under way early in 1959 on the navy Polaris, a two-stage solid-propellant IRBM.

Although guided missiles of the Atlas, Thor, Jupiter, and Vanguard (navy) types belong essentially in the surface to surface class, they are being used extensively as booster vehicles for the exploration of outer space.

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**GUIDI.** See MASACCIO.

**GUIDO D'AREZZO**, or **GUIDO ARETINUS**, c. 995–c. 1050, Italian Benedictine monk, music theoretician, and teacher, born in Paris. Most of his life was spent in Italy. He perfected the hexachord, a system based on a recurring group of six diatonic tones with the semitone in the center. For purposes of memorizing music, the tones were designed by the syllables *ut* (or *doh*), *re*, *me*, *fa*, *sol*, *la*. This system was the forerunner of the movable *doh* systems of today and of the present system based on the octave. Guido also improved the notation, increasing the two-line staff to four lines. His influence is seen in the music lesson in Shakespeare's *Taming of the Shrew* and in the music of Sweelinck, Byrd, and Bull.

**GUIDO RENI**, 1575–1642, Italian artist, was born near Bologna. He received his first artistic training in the studio of the Flemish painter, Calvaert. He continued his work under the Carraccis and soon became one of their best pupils. During this period he worked with Ludovico Carracci in ornamenting the Palazzo Publico in Bologna. After finishing his studies in that city, he went to Rome where he studied the painters of the Renaissance and the sculpture of the ancients. He is known for the beauty of form rather than the dramatic representation in his works. He painted in Rome under the pontificate of Paul V and taught his art there. Later in his life he returned to Bologna, where he established a school which became one of the most popular in the city. He acquired a fortune which he dissipated in gambling and other amusements. Most of his paintings are of religious and mythological subjects, though several portraits have been attributed to him. Some of the ornamentations he has done are: the dome of the Quirinal Palace, in collaboration with his former master, Antonio Carracci; frescoes in the Borghese Chapel of Santa Maria Maggiore; and the ceiling of Aurora in the Casino Rospigliosi, considered his greatest masterpiece. His paintings "The Crucifixion of Saint Peter," "The Annunciation," "The Transfiguration," and "The Ascension" are in the Vatican, and many others are in museums throughout Europe. HELEN STEWART

**GUIENNE**, or **Guyenne**, former province of France, drained by the lower Garonne and Dordogne. With Gascony, it was the ancient Aquitania, of which Guienne is a corruption. By the marriage of Henry II

of England with Eleanor of Aquitaine (1152) Guienne became English, but reverted to France at the end of the Hundred Years' War.

**GUIGNOL**, **THÉÂTRE DE GRAND**, a playhouse in a gaslit alley off the Rue Chaptal, Montmartre, Paris, which specializes in bloodcurdling drama. Founded in 1897, the theater has become so much a part of French culture that the term, *grand-guignolesque*, has appeared in the language to signify a horror drama. Much of the Grand Guignol's success has been due to its realistic methods. The blood used in the murder scenes is made from a secret formula and actually congeals. About 1,000 dramas are in the theater's repertoire and of the 30 classics that are repeated every year, the majority were written by André de Lorde (called the Prince of Terror). The plays are all one-acters and include such titles as *The Dead Rat*, *The Corpse Merchant*, and *Crime in a Madhouse*. The Grand Guignol has an ancient tradition behind it. Guignol was originally a stock character in 18th century French puppet shows, whose action was of a gruesome nature.

**GUILBERT, YVETTE**, c. 1865–1944, French lyric artist, was born in Paris and educated at a St. Lô convent. She studied dramatics under Landrol and made her debut (1885) in *La Reine Margot* at the Théâtre Bouffe du Nord. In 1889 she began to perform as a *diseuse* and soon won popularity as a café-concert entertainer. At first she sang risqué songs, often in low French dialect, but she later turned to the song-recital of old French ballads, presenting these mainly in her tours of Europe and America. She published her memoirs, *La Chanson de ma vie*, in 1927.

**GUILD**, a medieval association. Some writers connect it with the Roman *collegia*, and enough evidences exist among the Roman cities of the south of France to render the theory plausible; many German writers trace the origin to early Germanic drinking bouts. The guilds (or gilds) were voluntary associations of merchants and artisans for purposes of mutual aid, protection, and social intercourse. They provided fraternal co-operation, but they also exercised economic control and were often invested with great political power.

The earliest guilds were religious or semireligious fraternities with little economic significance. It is probable, however, that these early fraternities formed a nucleus around which the earliest municipalities developed. Apart from this political role these religious guilds performed charitable, educational, and certain judicial functions. By the 11th century merchant guilds mushroomed all over Europe. Originally they included traders and craftsmen in the same branch of production, but in the later development the craft guilds, composed exclusively of artisans, separated from the merchant guilds, made up entirely of middlemen and traders. On the European continent the merchant guilds developed great power. They acquired vast privileges and judicial and legislative powers in the cities, and it was guild officers who ruled the large commercial cities such as Genoa and Venice or Bruges and Nuremberg.

Whereas the merchant guilds performed chiefly political functions, the purpose of the craft guilds, which flourished from the 14th to the 16th century, was primarily economic. They were organizations of artisans of the same craft, commonly called "masteries." The purpose of the guild was, apart from its fraternal function, to exercise economic controls over its members. The guild fixed prices and determined qualities of the products of the artisans; it decided the number of journeymen and apprentices a master might have; it watched over the strict performance of the various obligations and the morals of all men affiliated with the guild. Every craftsman had to be a member of the appropriate guild and was subject to its regulation.

With the development of elementary machinery the guild regulations became oppressive, since they



were based on maintaining an individual status and left no room for personal initiative. As the new industries developed they acquired royal privileges to remain outside the guilds, and many masters who would have been subject to guild regulations preferred to settle in villages where guilds had not developed. In some trades the guilds maintained themselves on the Continent until the impact of the French Revolution, but most of them had lost all importance in England by 1650, except as fraternal organizations.

See FEUDAL SOCIETY; HANSEATIC LEAGUE; MIDDLE AGES; RENAISSANCE; LONDON; GUILD SOCIALISM.

BERT F. HOSELITZ

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**GUILD SOCIALISM**, the English expression of the doctrine of SYNDICALISM which advocated public ownership of the means of production but with control vested in guilds of workers. The principal advocate of guild socialism was G. D. H. Cole; it was supported also by S. G. Hobson, a famous English intellectual. Influenced by the emphasis which syndicalism placed on the need for giving the worker an adequate share in the administration of industry, the English guildsmen formed in 1915 a National Guilds League, which was dedicated to the "abolition of the wage system and the establishment of self-government in industry through a system of national guilds in conjunction with the state."

Under guild socialism the ownership of industry would be in the hands of the state or commune. The industry would be managed, however, by local, state, or national guilds. Each guild would include all workers in an industry, trade, or profession—managerial and technical, as well as manual workers. These guilds would be given virtual autonomy within their own spheres as long as they performed their functions satisfactorily. Under the democratic controls set up by the guilds the worker would no longer be regarded "merely as the mortal tenement of so much labor power for which an efficient demand exists," but as a human being capable of sharing in the conduct of industry. While agreeing on the main aim of democratic control, guildsmen widely differed among themselves on the details of the guild society, especially on the relations between the guilds and the state and on the functions—both national and international—to be left with the state.

In 1925 the National Guilds League was dissolved. Since then the whole movement has disappeared, and the doctrine has been abandoned even by G. D. H. Cole. Nevertheless guild socialist ideas have been accepted by some of the intellectual leaders of the Labor Party. See SYNDICALISM; SOCIALISM; COMMUNISM.

HARRY W. LAIDLER

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**GUILDFORD**, municipal borough and county town, England, in Surrey, 30 miles SW of London. The church of St. Mary, built of flint and chalk, contains curious frescoes. The town hall dates from 1683, a free grammar school from 1509, and a hospital for aged persons, founded by Abbot, archbishop of Canterbury, from 1619. The principal object of interest is the Norman keep of the old castle. During the Plantagenet period it was an occasional royal residence. Pop. 47,484.

**GUILDHALL**, former edifice in the city of London, long identified with civic conclaves and feasts of the corporation and with pageantry on Lord Mayor's Day (Nov. 9). It was involved in the great fire of 1666, and the edifice that stood until World War II dated only from 1789; it was designed by George Dance. It was destroyed, together with the giant wood statues of GOG AND MAGOG, in the incendiary bomb raid on Dec. 29, 1940.

**GUILFORD COLLEGE**. See COLLEGES.

**GUILFORD COURT HOUSE, BATTLE OF**, an engagement of the Revolutionary War fought March 15, 1781, at Guilford Court House, N.C. The American forces under the command of Gen. Nathaniel Greene had retreated across North Carolina into Virginia, followed by Cornwallis. After gaining reinforcements Greene turned southward into North Carolina and offered battle at Guilford Court House. His army numbered 4,404 men, including 3,000 raw militia; Cornwallis had a force of 2,213 veterans. The British attacked Greene's position four times, carrying first a field, then a wood, and lastly a hill. After five hours of severe fighting Greene ordered a retreat, having lost 79 killed and 184 wounded, not including 1,000 militia who had deserted in the midst of the battle. The British lost 93 killed, 413 wounded, and 26 missing. The loss of nearly a fourth of his army compelled Cornwallis to retreat shortly afterward, abandoning most of the Carolinas to the Americans. The battle has therefore been claimed as a strategic victory for Greene. See REVOLUTION, AMERICAN; GREENE, NATHANIEL.

**GUILLIELMA**, a genus of tropical American palms with spiny, feather-like leaves, spiny ringed trunk, and large, edible fruits. It grows well on sandy loam containing peat and leaf mold. The peach palm, *G. gasipaes*, is an important species.

**GUILLAUME, CHARLES EDOUARD**, 1861–1938, French physicist, was born in Fleurier, Switzerland, and studied at the Neuchâtel Polytechnic Institute and the University of Zurich. Becoming associated with the International Bureau of Weights and Measures in Sèvres in 1883, he was appointed associate director (1902) and director (1915). He received the 1920 Nobel prize in physics for his discovery of the nickel-steel alloy known as invar. Because this alloy has a very slight coefficient of linear expansion with increases in temperature it is applied to watchmaking and to the construction of geodetic measuring rods. Guillaume wrote *Thermometry of Precision* (1889), *Units and Standards* (1893), *Nickel and Its Alloys* (1898), *Applications of Nickel-Steels* (1904), *Progress of the Metric System* (1907), and *New Thermometric Studies* (1929).

**GUILLEMEN, AMÉDÉE VICTOR**, 1826–93, French critic and popularizer of science, was born in Pierre, Saône-et-Loire; wrote popular books on physics and astronomy, such as *Le ciel* (1864; 5th ed. 1871); *Le soleil* (1873); *Les phénomènes de la physique* (1867); *Le monde des comètes* (1877); *L'électricité et le magnétisme* (1891)—all translated into English; though his most comprehensive work is *Le monde physique* (5 vols. 1880–85).

**GUILLEMOT**, a member of the Auk family. The common guillemot, *Uria aalge*, breeds on all rocky coasts of the North Atlantic and North Pacific. The bill is long, straight, and strong, the wings and tail short. In spring the upper surface of the body is brownish black, the under, white, save for the dark throat; in winter the throat becomes white and mottled. Much less common except in the far north, is the black guillemot, *Cephus grylle*. The common guillemot lays only a single pear-shaped egg on the ledge of a sea cliff. It makes no nest whatever, and large colonies brood in company.

**GUILLOTINE**, an instrument employed for the purpose of decapitation. It has been used in Scotland, England, and on the continent for several centuries. In a later period it was extensively used in the French Revolution. It was officially introduced in April, 1792. When first used, however, the guillotine was known as *Louissette* or *La Petite Louison*. It was named after Dr. Joseph Guillotin (1738–1814), professor of anatomy in Paris, who did not invent the machine but had recommended it to the National Assembly as early as 1789. In his final report to the Assembly he pointed out that "with my machine I chop your neck off so swiftly that you don't even



notice it." Contrary to popular belief, Guillotin was not a victim of the instrument he had proposed but died a natural death. The guillotine consists of two upright posts held together at the top by a crossbeam. The posts are grooved to allow the oblique broad steel blade to fall smoothly. The original ivory miniature model of the machine can still be seen in the Carnavalet Museum in Paris. See FRANCE, History, *The Reign of Terror*.

**GUILMANT, FELIX ALEXANDRE**, 1837–1911, French organist and composer, was born in Boulogne and studied under his father and with Garulli and Lemmens. He settled in Paris in 1871 and was organist at La Trinité until 1901. Professor of the organ and one of the founders of the *Schola cantorum*, his pupils included such men as Dupré and Cellier. His works comprise the lyric scena, *Belsazar*, two symphonies for organ and orchestra, and sonatas, motets, and masses. He also edited the organ collections, *École classique de l'orgue* and *Archives des maîtres de l'orgue*, the latter with André Pirro.

**GUILT FEELING**. See PSYCHOANALYSIS, *Psychoanalytic Conception of the Personality*.

**GUIMARAS ISLAND**, one of the Philippines, Iloilo Province, separated from the E coast of Panay by narrow Iloilo Strait, and from the W coast of Negros by Guimaras Strait, the island is 27 miles long, 12 miles wide; area 234 sq. mi.; pop. (1948) 38,500. The greatest height on the island (825 ft.) rises in the center. Wooded heights rise close to the east coast, and the western part has fertile valleys. The chief towns, Nueva Valencia and Jordan on the west coast, are connected by highway. The west coast has two well-sheltered anchorages. The chief products are rice, hemp, cotton, corn, and tobacco; fishing is important.

**GUINEA**. See FRENCH GUINEA; RIO MUNI; PORTUGUESE GUINEA.

**GUINEA**, an old English coin first issued in 1663 and discontinued in 1831. When first struck this gold coin was intended to be used only by The Company of Royal Adventurers of England Trading with Africa. The pieces bore inscriptions of small elephant-like figures and were minted of 22-carat gold supposedly mined in Guinea. When the coin was originally issued it had a prescribed value of 20 shillings, but this value was frequently raised to 21 shillings as a result of the fluctuations of the silver market. To prevent speculation, a 21-shilling value for the guinea was officially established in 1778. Several variations of the standard guinea were introduced; the double guinea, so called because its value, was equivalent to two guineas, and the spade guinea derived its name from the form of escutcheon that was embellished on the reverse side of the coin. The spade guinea was authorized in 1787 but was recalled in 1800.

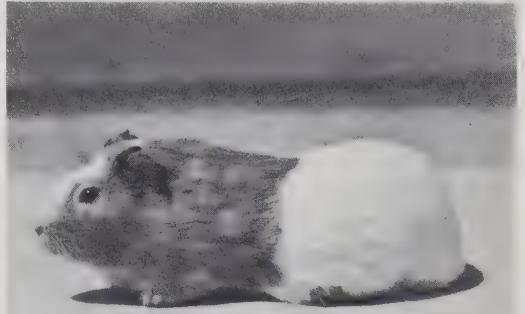
**GUINEA FOWL**, the African representative of the pheasants, from which they differ in that the plumage of both sexes is alike. The origin of the domesticated stock is *Numida meleagris*, from West Africa. A number of other species occur in other parts of Africa. In the black guinea fowl (*Phasidus niger*), which ranges from Cape Lopez to Loango, spurs are present in the male as in pheasants. Guinea fowl are nearly all gregarious, are ground feeders, and roost in trees. Most species seek to escape danger by running rather than by flying. As in the turkeys, parts of the head and neck are without feathers, and these bare patches are often highly colored.

**GUINEA GRASS**, a perennial tropical West African grass, highly esteemed in its native lands and in the West Indies and southern United States as a fodder plant. Guinea grass, *Panicum maximum*, grows from 8 to 10 feet in height.

**GUINEA, GULF OF**, on the W coast of Africa, between Cape Palmas (SE of Liberia) and Cape Lopez, lat. 6° 30' N to 1° S; long. 8° 30' W to 10° E. On the north and east are two open bays, known as the Bight of Benin and the Bight of Biafra.

**GUINEA PEPPER**. See BELL PEPPER.

**GUINEA PIG**, the domesticated CAVY (*Cavia porcellus*). Guinea pigs were domesticated by the South American Indians about 2,000 years ago and were introduced into Europe by the Dutch in the 16th century; but while the wild caviés are in color uniform or dull, the guinea pigs are usually white, or white marked with yellow and black. Like the wild caviés, they have four toes on the fore feet and three on the hind, the tail is absent, and the ears are small.



Guinea Pigs, favorite pets with children, are also used extensively in medical research laboratories

Pretty though stupid creatures, guinea pigs have always been favorite pets with children. They are extraordinarily prolific and very hardy if kept in dry and warm situations. They are used extensively in bacteriological laboratories for investigations in experimental medicine.

**GUINEA WORM**, *Dracunculus medinensis*, (also called medina, serpent, or dragon worm) is a round-worm parasitic to man and endemic to many parts of Africa, India, and Arabia. The parasites are long and threadlike, the females averaging three feet in length. They infest the subcutaneous and deep connective tissues, usually of the lower extremities. Larvae pass from blisters in the skin into water where they are ingested by copepods. Infection is spread to other human beings when they drink water containing these infected copepods. Prevention of infection consists of eliminating unsanitary water supplies or treating them with lime. Phenothiazine emulsion is used to treat the disease in man.

**GUINEGATE**, village, France, in the department of Pas-de-Calais, 10 miles S of Saint-Omer. Here in 1513 Henry VIII of England and Emperor Maximilian defeated the French in the Battle of the Spurs.

**GUINES**, town, Cuba, Havana Province, on the Mayabeque River, about 46 miles SE of Havana. It is a trading center for a fertile country which also produces coffee and livestock. Pop. (1953) 29,226.

**GUINES**, village, France, in the department of Pas-de-Calais, six miles S of Calais. Three miles east is the "Field of the Cloth of Gold," where in 1520 took place the famous meeting between Francis I of France and Henry VIII of England.

**GUINEVERE**, wife of King Arthur. The Welsh *Triads* know three ladies of this name, each of whom was wife to Arthur; and the *Merlin* relates that the queen had a half sister of the same name, born out of wedlock, who closely resembled her. In the prose *Lancelot* we find that this lady succeeded, by a daring ruse, in causing the banishment of the real queen, whose place she usurped. This seems to point to a mythic origin of the character, and a famous adventure attributed to Guinevere—that of being abducted by a rejected lover, variously named Melwas, Meleagant, or Falerin, and imprisoned in a mysterious castle under conditions which recall the abode of the



dead or other world—appears to favor this conclusion. The tradition of Guinevere's infidelity to her lord is an early feature of the story. In Geoffrey and his translators her lover is Mordred; but the romance writers represent the queen as having no share in Mordred's treachery. At a comparatively late stage of Arthurian evolution Guinevere was provided with a new lover in the person of Lancelot, who is not mentioned in the earliest documents, and this *liaison* became the central point of Arthurian romance in its latest development. The writings of Malory and Tennyson have made this story familiar. See LANCELOT DU LAC.

**GUINEY, LOUISE IMOGEN**, 1861–1920, American poet and essayist, was born in Boston. Much of her life was spent in England, and her work as a whole reflects the English and Catholic traditions. Her poems include *Songs at the Start* (1884), *England and Yesterday* (1898), *The Martyr's Idyl* (1899), *Happy Ending* (1909). Among her prose works are *Goose-Quill Papers* (1885); *A Little English Gallery* (1894); *Patris* (1897).

**GUINICELLI, GUIDO**, c. 1230–76, Italian poet, was born in Bologna. He became a judge in his native town, and in 1270 podesta of Castelfranco. He was banished as a Ghibelline in 1274 and died in exile. Most of his poetry is erotic in theme, marked by a philosophic cast of thought. In the beginning his work was imitative of the Provençals and Sicilians, but he later developed a distinctive style, rich in imagery. Dante regarded him as the father of Italian poetry. Guinicelli founded a school of poets at Bologna. His best known poem is "The Gentle Heart," translated into English by D. G. Rossetti.

**GUINOBATAN**, town, Philippine Islands, Luzon, Albay Province, nine miles NW of Legaspi, on the Legaspi-Manila Railway and a highway junction. It is the center of a hemp-growing district. Pop. (1948) 32,280.

**GUIPUZCOA**, a Basque province in NE Spain, bounded on the N by the Bay of Biscay, on the SW by Vizcaya, and on the SE by Navarra; area 728 sq. mi.; pop. (1952) 379,866. The province is mountainous and picturesque. Among its many manufactures are paper, textiles, gold work products, wines, and liqueurs. Guipúzcoa is rich in minerals and its fisheries are important. The capital is San Sebastián.

**GUÍRA DE MELENA**, town, W Cuba, in Havana province, about 24 miles SSW of Havana in a sugar-producing region. Pop. (1943) 10,824.

**GUISCARD, ROBERT**, c. 1015–85, duke of Apulia and Calabria, was a son of the Norman Tancred de Hauteville, and was born near Coutances in Normandy. Proceeding to Italy while still young, he was made duke of Apulia in 1056, and even opposed successfully Pope Gregory VII (1073–81). In 1081 he carried an army across the Adriatic, defeated the Byzantine emperor, Alexius Comnenus, at Durazzo, and penetrated to Thessalonica (Saloniki), whence he was recalled to protect the pope against Emperor Henry IV. He stormed and plundered Rome, freed the pope from the castle of San Angelo (1084), and took him to Salerno for safety. Then returning to the east, he defeated the fleet of the allied Byzantines and Venetians near Corfu in 1085, but died at Cephalonia while preparing to march on Constantinople. See BOHEMOND I.

**GUISE, CHARLES DE, CARDINAL OF LORRAINE**, 1524–74, French churchman, brother of the second Duke de Guise. At 14 he became archbishop of Rheims. An implacable foe of the Huguenots, he had great influence at court and introduced the Inquisition into France.

**GUISE, CLAUDE DE LORRAINE, 1st DUKE DE**, 1496–1550, French general and founder of the powerful Guise family. He was a son of René II, duke de Lorraine. He accompanied Francis I in his Italian campaign, was created duke de Guise, and later fought in Flanders. His daughter married James

V of Scotland and was the mother of Mary, queen of Scots.

**GUISE, FRANÇOIS DE LORRAINE, 2nd DUKE DE**, 1519–63, French general and Catholic leader, son of the first Duke de Guise. He defended Metz against Charles V (1552) and recovered Calais from the English (1558). During the reign of Henry II, François and his brother Charles, cardinal of Lorraine, were influential. They advanced the persecution of the Huguenots and married a relative, Mary, queen of Scots, to the heir to the throne. With the end of the reign (1559–60) of her husband, Francis II, the family's unquestioned influence waned under the growing power of the Bourbons and their Protestant allies and the jealousy of CATHERINE DE' MEDICI. François defeated the Huguenots at Dreux (1562) but was assassinated at Orleans by a Huguenot.

**GUISE, HENRI, 3rd DUKE DE**, 1550–88, French Catholic leader, son of the second Duke de Guise. He distinguished himself fighting against the Huguenots, took a leading role in the St. BARTHOLOMEW MASSACRE (1572), was a leader in forming the Catholic League (1576), and violently opposed the succession of Protestant Henry IV to the French throne. He was active in the Wars of the Three Henrys but was not powerful enough to establish the views of the extreme Catholics. Henry III had him assassinated.

**GUISE, HENRI, 5th DUKE DE**, 1614–64, French Catholic nobleman, grandson of the second Duke de Guise. He was archbishop of Rheims but on inheriting his family title, he left the church and fought against Richelieu (1641–42), was active in the insurrection of Masiello at Naples (1647), and was imprisoned by the Spanish (1648–52). The house finally became extinct on the death of Marie, duchess of Lorraine, in 1688.

**GUISE**, town, N France, in the department of Aisne, on the Oise River, 25 miles N of Laon. The town has an ancient church and the ruins of a 16th-century castle, the former seat of the dukes of Guise. Here is a large co-operative iron works founded by the philanthropist Godin in 1888. Guise became a duchy in 1527. The town was under German occupation during World War I and World War II. Guise is the birthplace of the French Revolution hero Camille Desmoulins. Pop. (1954) 5,846.

**GUITAR**, a plucked-string musical instrument descended from the lute. Retaining the lute's flat breast and large circular sound hole, the modern guitar has a flat back and curving sides, and is somewhat violin-like in shape. It has six strings, three of gut and three of silk overspun with wire, which are tuned to E, A, D, G, B, E. For ease in reading, guitar music is notated one octave above its actual sound. It is played by plucking the strings with the fingers of the right hand or with a pick, while the left hand regulates pitch and forms chords by depressing the strings against a fretted finger board. The guitar is

**Andrés Segovia, the greatest virtuoso of the guitar**





especially suited to voice accompaniment. Although its popularity declined with the invention of the piano, the instrument never lost its appeal for folk singers and "blues" artists, while many twentieth century composers of serious music wrote compositions especially for it.

**GUITERAS, JUAN**, 1852–1925, Cuban physician, was born in Matanzas. The United States government appointed Guiteras, a graduate of the universities of Havana and Pennsylvania, to the Havana Yellow Fever Commission (1879). He was associated with Maj. William Gorgas on a board for the diagnosis of yellow fever (1898), which brought him into contact with Maj. Walter Reed who was investigating transmission of the disease. Guiteras, through independent experiments, verified Reed's findings that the disease is transmitted by mosquitoes. He was director of public health in Cuba (1902–21), and he made many valuable contributions to the knowledge of tropical medicine.

**GUITRY, LUCIEN GERMAIN**, 1860–1925, French actor and manager, was born in Paris. He entered the conservatory in 1876, made his debut in *La dame aux camélias* in 1878, and played nine years at the St. Michel, St. Petersburg. When he returned to Paris he became stage manager and director at the Porte St. Martin Théâtre and the Comédie Française and, later (1902–9), actor and director at the Théâtre de la Renaissance. Winning his highest honors in plays of Anatole France, Émile Zola, Henri Bernstein, and his own son, **SACHA GUITRY**, Lucien Guity was considered the leading male actor in France after the death of Ernst Coquelin (1909). He was famed for his restraint and his moderation in gestures and theatrical effect.

**GUITRY, SACHA**, 1885–, French actor and dramatist, was born in St. Petersburg. He made his debut (1902) at the Renaissance Théâtre in Paris in a play directed by his father, **LUCIEN GUITRY**. He is the author of more than 60 plays noted for their vivacity and droll caricature. He wrote several plays for his father and many in which he himself starred, notably, *Mon père avait raison* (1920), *Mozart* (1926), and *Désiré* (1932). Guity made his motion picture debut in 1935 and has since written, directed, and acted in several pictures, including *Le roman d'un tricheur*, *Les perles de la couronne* (1937), *Champs Élysées* (1939), and *Nine Bachelors* (1942). He was accused of fraternizing with the Nazis during the occupation, but was cleared of all charges by the French government (1947). Guity wrote *If I Remember Right* (1935).

**GUIUAN**, seaport, Philippine Islands, on the SE extremity of Samar, 75 miles SE of the Samar Island capital, Catbalogan. Guiuan is the terminus of the east coast highway. On a reef near the fine harbor are sulfur springs, which are covered at high tide. The chief export is coconut oil. Pop. (1948) 27,202.

**GUIZOT, FRANÇOIS PIERRE GUILLAUME**, 1787–1874, French statesman and historian, was born in Nîmes. Coming to Paris in 1805, he soon began to contribute to *Le Publiciste*, and became known in literary society. In 1812 he was elected to the chair of modern history in the University of France. On the fall of Napoleon he was appointed secretary general of the interior in Louis XVIII's first administration, being promoted to the council of state (1816). He came to the front as a leader of the party of the "Doctrinaires"—liberal moderates, who advocated a *juste milieu* between Republican extremes and Legitimist reaction. On the fall of the Duc Decazes ministry (1821) he was deprived of all offices, and in 1825 even his lectures were prohibited. For the next five years he was conspicuous as an opponent of Charles X's government. In 1830 Guizot entered the Chamber; on the fall of Charles X he was included in the first cabinet of Louis Philippe, and on its reconstruction (1832) became minister of public instruction. He became the true father of modern educational organization in France. His rivalry with Thiers began,

and when the latter became minister for foreign affairs (1840), Guizot accepted for a time the post of French ambassador in London, where he was warmly welcomed by English society. But the same year he was recalled by the king, and entrusted with the task of forming a new ministry, which lasted for eight years, and consistently encouraged the *entente cordiale* with England. The revolution of 1848, largely brought about by his refusal to make the concessions demanded by the spirit of the age, was the end of Guizot's political life. His chief works, also available in English translation, are *Histoire de la révolution d'Angleterre* (2 vols. 1826–27, continued in 6 vols. 1850–56); *Histoire de la civilisation en Europe* (1828); *Histoire de la civilisation en France* (5 vols. 1829–32); *Histoire de France racontée à mes petits enfants* (5 vols. 1870–75); *Vie, correspondance et écrits de Washington* (1840). See HISTORY.

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**GUJARAT**, region, in W India, the area about the Gulf of Cambay. The Gujarati-speaking people inhabit the northern districts of Bombay Province, Cutch, and the Kathiawar Peninsula. The region is usually limited, however, to the area north of the Narbada River and includes Cutch and Kathiawar. The greater part of the region is divided into many small feudatory states, which are administratively under the Baroda, Western India, and Gujarat States Agency.

**GULBARGA**, city, India, Hyderabad State, capital of Gulbarga District, 110 miles by rail W of Hyderabad city. Once Hindu, it was made the capital of the Moslem Bahmani kings (1347–1422), and the palaces, mosques, fort, and tombs of that dynasty are partly in ruins. Gulbarga is an important trading center and has manufactures of cotton, flour, paint, and oil. Pop. (1951) 77,189.

**GULF INTRACOASTAL WATERWAY**, a system of canals, connecting protected bays and inlets on the coast of the Gulf of Mexico, from Carabelle, Fla., to the Mexican border at Brownsville, Tex. The



CORPUS CHRISTI, C. OF C.

#### A canal of the Gulf Intracoastal Waterway

completed portion extending about 1,000 miles from Carabelle, Fla., to Corpus Christi, Tex., has a depth of 12 feet and a width of 125 feet. The Intracoastal Waterway will connect with the Intercoastal Waterway, which has a 12-foot depth from Trenton, N.J., to Jacksonville, Fla. See WATERWAYS, INLAND.

**GULF STREAM.** See OCEAN.

**GULFPORT**, city and port of entry, SE Mississippi, county seat of Harrison County; on the Mississippi Sound (Gulf of Mexico); the Illinois Central, and the Louisville and Nashville railroads; U.S. highways 49 and 90; and the National Air Lines; 12 miles W of Biloxi. Gulfport is a popular year-round resort and an important seaport with a deep water harbor. It was laid out in 1898. Near by is the



Gulf Park College. Cotton, lumber, fertilizer, and naval stores are exported through the port, and the city's manufactures include shirts and dairy products. Pop. (1950) 22,659.

**GULFWEED**, the name commonly given to various species of *Sargassum*, a genus of brown algae. *Sargassum* plants are especially abundant in the warmer seas of the world, for example, on the coasts of southeastern United States, the West Indies, Central America, northern South America, in the Medi-



L. W. BROWNELL

#### Gulfweed, showing the buoyant air bladders

terranean, and on the coasts of Africa, Australia, tropical Asia, and adjacent islands. Gulfweeds are branched and leafy, and bear numerous, buoyant air bladders. Huge, floating masses of sargassum occur in the Sargasso Sea, a part of the Atlantic Ocean located between the United States, the Azores, the west coast of Africa, and the West Indies. Unfounded legends have frequently arisen in literature about the trapping of ships in these large masses of seaweed. Many bizarre marine animals live in association with the gulfweed. See ALGAE; SEAWEED; SARGASSO SEA.

H. J. FULLER  
**GULICK, JOHN THOMAS**, 1832-1923, American missionary and evolutionist, brother of LUTHER HALSEY GULICK, was born in Waimea, Kauai, Hawaiian Islands, and studied in the United States at Williams College and Union Theological Seminary. His career as a missionary was spent in Peking (1864), Kalgan, North China (1865-75), and Japan (1875-99). An ardent evolutionist, Gulick wrote *Evolution, Racial and Habitual* (1905), in which he explained his theory of the divergence of evolution.

**GULICK, LUTHER HALSEY**, 1828-91, American Congregationalist missionary, brother of JOHN THOMAS GULICK and father of LUTHER HALSEY GULICK, was born in Honolulu, Hawaii, and studied at the medical college of the University of the City of New York. He was sent to the Caroline Islands as a medical missionary in 1852, and from 1863 to 1870 was superintendent of the Hawaiian Evangelical Association's missions. He inspected mission conditions in the south of Europe (1871-74) and in 1875 became agent in the East for the American Bible Society.

**GULICK, LUTHER HALSEY**, 1865-1918, American physical training educator, was born in Honolulu,

Hawaii, and studied at Oberlin College, the Sargent School of Physical Training, and the Medical College of New York University. While directing the Y.M.C.A. physical training course in Springfield, Mass. (1886-1903), he, with JAMES NAISMITH, devised the game of basketball. He was director of physical training of the New York Public Schools (1903-7) and director of the child hygiene department of Russell Sage Foundation (1907-13). With his wife he organized the Camp Fire Girls and was its first president (1913). In 1917 he made a survey of the Y.M.C.A. work with the American Expeditionary Forces in France. He wrote *The Dynamic of Manhood* (1917).

**GULL**, a heavy-bodied, web-footed bird which together with the tern comprises the family *Laridae* of the order Longipennes. Gulls are essentially marine birds despite the fact that not a few species nest inland. The upper half of the beak is longer and has the tip bent down over the lower half; the tail is usually square. The birds vary in color but in the adult stage are usually white with shades of gray; seasonal changes in color are marked. Their food consists of surface-dwelling fishes and practically any kind of organic matter floating on the surface of the water. All gulls make very simple nests on sandy beaches and lay about four heavily spotted eggs. Gulls are valuable scavengers, ridding the oceans and bays of various kinds of offal. Certain inland species are an agricultural aid, for they feed on destructive crop insects.

Most familiar forms of gulls belong to the genus *Larus*. The large and handsome herring gull, *L. argentatus*, is widely distributed, and in winter frequents harbors far south of its breeding range. Large colonies of the ring-billed gull, *L. delawarensis*, breed on interior marshes as well as on the coast; and the laughing gull, *L. atricilla*, is common all along the Atlantic coast. The common gulls of the Pacific coast include the California gull, *L. californicus*, the Western gull, *L. occidentalis*, and Heermann's gull, *L. heermanni*.

**GULLIVER'S TRAVELS**, the famous satirical fantasy of Jonathan Swift, was first published as *Travels into Several Remote Nations of the World, By Lemuel Gulliver, First a Surgeon, and then a Captain of Several Ships* (1726). In the year of publication the work went through numerous editions, including several in pamphlet form. It rapidly attained the stature of a classic, and has never lost its appeal for both adults and children. According to Pope, Swift borrowed some of his ideas from Arbuthnot's *Memoirs of*

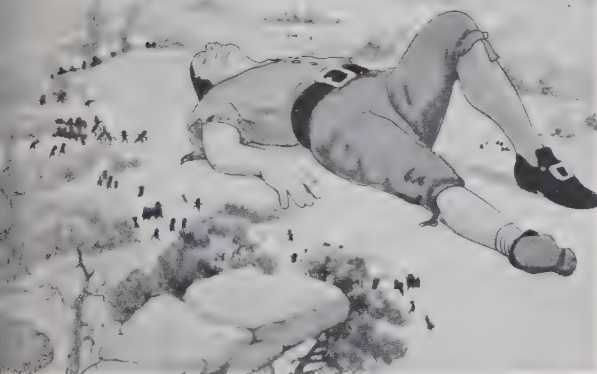


ALLAN D. CRICKSHANK FROM NAS

#### Herring gull stands guard over its nest



*Scriblerus*, a paper prepared for the Scriblerus Club, of which they were all members. Except for passages in the third part of *Gulliver*, however, there is little similarity to the Scriblerus satire. Lemuel Gulliver, a ship's doctor, in the accidents of his voyages, visits, first, Lilliput, a land inhabited by diminutive people the tallest of whom is only six inches high. In the description of their wars and court intrigues are satirized the wars and the religious and political quarrels of England. Succeeding voyages take him to the land of the Brobdingnagians, whose massive proportions suggest the relativity of power and grandeur, and to Laputa, a flying island, inhabited by crackpot scientists and philosophers and by the Struldbruggs, a deathless race which views its immortality as the height of wretchedness. Gulliver's last sojourn is in the country of the Houyhnhnms, a race of thinking horses. The comparison between the virtuous Houy-



PARAMOUNT PICTURES

#### Scene from motion picture, "Gulliver's Travels"

nhnms and their slaves, the bestial, manlike Yahoos, illustrates Swift's misanthropy at its bitterest.

**GULLSTRAND, ALLVAR**, 1862-1930, Swedish ophthalmologist, was born in Landskrona and studied at the universities of Uppsala, Vienna, and Stockholm. In 1894 he became professor of ophthalmology at the University of Uppsala and in 1913 professor of physiological and physical optics. For his mathematical investigations of dioptrics, or the science of refraction of light through the transparent media of the living eye, he received the Nobel prize in 1911. Gullstrand also received recognition for his studies of astigmatism and for the inventions of a stationary ophthalmoscope and of corrective glasses to be worn after cataract operations.

**GUM**, a term applied to a number of widely differing substances of a more or less sticky nature. The gums proper are almost entirely obtained from plants, and dissolve in water to a more or less perfect solution, and are hydrolyzed to sugars by boiling with dilute acids. Typical examples are tragacanth, gum arabic, agar-agar, and Iceland-moss gum. The gum resins are also obtained from plants, and contain a certain amount of true gum, but are chiefly important on account of the resins and essential oils that are present, and are insoluble in water. They are of very different natures, and are exemplified by ammoniacum, gamboge, asafoetida, myrrh, etc. Benzoin, and some similar substances also called gums, are in many respects like the gum resins; but as they contain not true gum, they are better classed as balsams. A solution of the commercial mixture known as dextrin, obtained by heating, or acting with acids,

etc., on starch, is, like the true gums, largely used as an adhesive and thickening agent in calico printing, etc., taking the place of natural gums. Gums are also employed in pharmacy and bacteriology as vehicles and culture media. Chewing gum consists principally of chicle gum from the naseberry tree (*Achras sapota*), sweetened and flavored. Gums from air-exposed oils are oxidation products. See RESIN.

**GUM**, the flesh covering the alveolar process of the jaw. See PYORRHEA and GINGIVITIS; TEETH.

**GUM ARABIC**, also called **Gum ACACIA**, is the dried, gummy substance exuding from the stems and branches of all African and some Arabic ACACIA trees. Its watery solution, called *mucilage*, is sticky and pastelike and is widely used in medicine and pharmacy. The Greek historian, Herodotus, and the founder of medicine, Hippocrates, were both familiar with the adhesive qualities of gum arabic.

Mucilages are soothing, demulcent agents well suited to allay the irritation of, and to protect, mucous membranes. They are favorite constituents of lozenges for sore throat. They also protect the lining of the gastrointestinal tract against the irritant effects of caustic and corrosive poisons and delay or diminish the intensity of the symptoms following ingestion of mineral acids, lyes, heavy metals, arsenic, formaldehyde, volatile oils, carbolic acid, lysol, silver nitrate, and iodine. In pharmacy and in industry gum arabic is chiefly used in the preparation of EMULSIONS, to provide cohesion in pills and lozenges, and to disguise the unpleasant taste of drugs.

In World War I a 6-7 per cent solution of gum arabic in physiological saline was used for intravenous infusions in *shock* to maintain blood pressure. Several individuals treated with gum arabic injections became acutely ill, developed headache, nausea, and vomiting. Occasionally the substance was deposited in large amounts in the liver and adversely affected the function of this organ. Recently the intravenous administration of gum arabic has been revived as a diuretic measure for patients suffering from dropsy due to a severe KIDNEY disease called nephrosis. These patients excrete in the urine large quantities of blood proteins, and therefore exhibit an abnormally low protein content of the blood which in turn leads to the fall of the colloidal osmotic pressure of the blood. The dropsy develops as a result of protein deficiency. A 6-7 per cent solution of gum arabic in saline has about the same viscosity and colloid content as the blood; therefore it approximates its colloidal osmotic pressure. Intravenous infusions of 6 per cent gum arabic solutions restore the low colloidal osmotic pressure of the circulating fluid and produce increased secretion of urine, with disappearance of the dropsy. According to recent authors gum arabic diuresis is also attributed to decreased tubular reabsorption in the kidneys, and not only the urine volume but also the salts, particularly the chlorides, in the urine are increased. It must be realized, however, that a gum arabic injection in kidney edema is only a temporary measure and does not cure the condition.

Gum arabic occurs as yellowish or amber colored, odorless tears or lumps, which are soluble in water but insoluble in alcohol. It is a colloidal carbohydrate which, upon boiling with mineral acids, yields simple sugars.

THEODORE KOPpanyi

**GUM, CHEWING**, an inexpensive confection, especially popular in the United States, but used in many parts of the world. Its base ingredient (from 25 to 100 per cent) is *chicle* gum, the sap of the sapodilla or naseberry tree found in Mexico, Guatemala and British Honduras. The trees are tapped by natives in much the same way as sugar maple trees. The chicle "milk" is boiled and cooled, and in the form of rough blocks is shipped to manufacturing centers, most of them in the United States. Here the crude chicle is refined, sterilized, and otherwise prepared by machinery. It is then put into large mixers, along with sugar, syrups, and flavoring agents such



as fruit extracts, licorice, cloves, spearmint or peppermint. When ready the gum is rolled in sheets, cut into sticks, wrapped and packaged, and sent to distributors in the United States and abroad. The United States, which is the world's largest buyer of chicle, imported 12,416,000 pounds in 1940. Its output of chewing gum in 1937 was valued at \$55,000,000.

The saps of spruce and other trees were used by the American frontiersmen as a form of "chewing gum." Like the Indians from whom they learned the custom, they found that its excitation of the salivary glands served to allay thirst. In World War II chewing gum was introduced into remote parts of the world by the American armed forces, where it found immediate favor with the natives who in tropical regions had traditionally chewed jungle tree resins, and in Arctic areas had chewed bits of blubber. The popularity of chewing gum in all strata of society in the United States has been a fruitful subject for satirists. On this theme Elbert Hubbard wrote in *The Philistine*, "This will never be a civilized country until we expend more money for books than we do for chewing gum."

**GUMAL PASS** crosses the Sulaiman Range from 160 to 170 miles SSW of Peshawar, giving access from Pakistan's North-West Frontier Province by means of a motor road to Fort Sandeman, where there is a junction with a railway to the Afghanistan border, to Kandahar, Afghanistan, and through southern Baluchistan to Iran.

**GUMBO.** See **HIBISCUS**.

**GUMMOSIS**, or **GUMMING**, the formation of exudates in solid masses on the surface of trees bearing stone fruits. It results from a diseased condition of the tree caused by bacteria (bacterial gummosis, *Pseudomonas cerasus*): by fungus disease (California blight, *Coryneum beijerinckii*): or by insect pest injury, as the San Jose scale. It is also a symptom of cell injury caused by adverse environmental conditions or faulty cultivation practices. Gummosis, however, is not always an indication of a diseased condition, for some plants have the peculiarity of forming hard gum masses on the surface of their stems.

**GUMTI RIVER**, N India, rises in the United Provinces, and after a sinuous but generally SE course of nearly 500 miles joins the Ganges about 25 miles below Benares.

## GUNS ❖ Weapons of War

*Guns helped end feudalism, and, developed in many sizes, became decisive in battle*

**GUN.** While this term may be held to cover any device consisting of a metal tube so contrived as to discharge a projectile by means of an explosive, the present tendency is to limit its application to large ordnance, to quick-firing and machine guns, and to the sporting gun as distinguished from the military rifle. The historical development of large guns is given in the article **ARTILLERY**. *Small Arms*, or those guns which are intended to be carried and used in the hands, are treated under **FIREARMS**; **RIFLE**; **REVOLVER**. Here the following are treated: (1) naval guns; (2) machine guns; (3) field guns; (4) siege and seacoast guns; (5) antiaircraft guns; (6) anti-tank guns.

### NAVAL GUNS

The naval gun seems to have been the natural successor of the incendiary tube fixed in the bows of galleys for discharging "Greek fire"—an incendiary composition containing ingredients (and some others) as black gunpowder. When guns were first used at sea is not absolutely certain, but in a celebrated old Japanese painting of the repulse of the Mongol fleet off the shores of Japan A.D. 1281, the Chinese vessels are shown wreathed in smoke from their guns. Kublai

Khan, the Mongol Chinese emperor, had an ordnance department at this time, and it is likely that he mounted guns on his ships. No records of the use of guns on board ship in European naval battles give a date for such use earlier than 1350, though some ships seem to have carried guns as early as 1346.

The guns of the 14th century appear to have been small, and were generally forged or cast; but early in the 15th century they began to increase rapidly in size. The smaller ones were nearly all breech-loading, and had a charging piece not unlike a beer stein, which contained the powder. The larger guns had increased in caliber too fast for the metallurgists of the time, and could be neither cast nor forged; so they were built up of iron or bronze bars or cylindrical staves and banded with numerous hoops. However, as early as 1468 bronze guns of the largest caliber were successfully cast (in two or more pieces), and early in the next century the casting of large guns had become common, nearly all of them being muzzle-loading. The augmentation of power to be obtained by increasing the weight of the powder charge was realized before this; but as the greater gas pressure in the gun made it difficult to keep the breech of breechloaders tight, muzzle-loading became the rule, and continued in favor until about 1850.

The first projectiles were of stone, but bundles or bags of stones, small balls, bits of iron, chain, and the like were also used. Early in the 15th century forged iron balls became common in France, and their efficacy against castles and fortifications led to their extensive use elsewhere. Exactly when cast iron projectiles were first used is uncertain, but they had replaced stone and wrought iron long before cast iron guns were made.

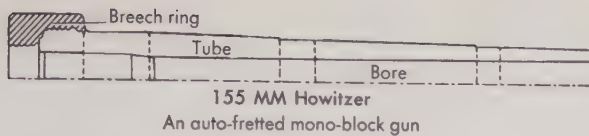
Ordnance of very large caliber was rarely mounted on board ship, the largest placed on seagoing vessels until the middle of the 19th century being pieces using shot of about 60 pounds weight. The exact type and size of an early gun is often difficult for modern students to determine from contemporary accounts for the names given were very loosely applied to weapons of different caliber and character.

The type of naval gun carriage which lasted for nearly three centuries is known to have existed in the time of Henry VIII. The *Mary Rose*, sunk in his reign, had brass guns with trunnions mounted in wooden carriages with heavy sides or "brackets," and supported on four small wooden wheels or trucks. The elevation was obtained by a wedge, and the recoil was limited by a breeching of heavy rope secured to the sides of the ports. No improvements were made on these guns or carriages in the 17th century; but early in the 18th the practice of casting guns solid and boring them out, instead of casting them in the final shape, resulted in a much smoother, more even bore of exactly the diameter intended, and added considerably to power and accuracy.

During the 18th century the numerous types and fanciful names of guns disappeared, largely through better knowledge of ordnance in all its branches, the consequent "survival of the fittest," and the simplification which always follows the incongruous and unreasoned terminology of important inventions during the process of development. The new classification concerned itself solely with the weight of the shot and of the guns. The latter were now known as long or short guns of so many hundredweight, and as 3-, 6-, 9-, 12-, 18-, 24-, 32-, and 42-pounders. The last-named size was rarely used until after the appearance of the carronades. These exceedingly short pieces, only five or six calibers in length, were found useful at close range, and were carried in considerable numbers by the smaller men-of-war about the beginning of the 19th century. Their shorter range rendered them less useful on large ships.

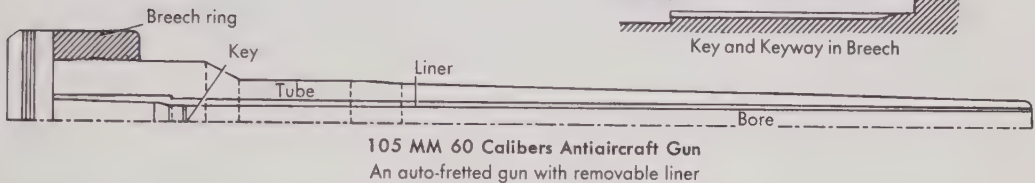
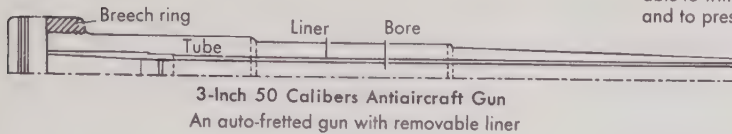
**Sights and Firing Devices.** Up to about 1800 no regular sights had been fitted to guns. They were aimed by sighting along the "line of metal" on the





## GUN CONSTRUCTION IN SECTION

The gun, as a hollow tube cantilever beam, must be able to withstand sudden, terrific internal pressures and to preserve its trueness against sag.



top of the bore. The necessary elevation at long range was largely a matter of guesswork, and was usually obtained by directing the piece at some point of the enemy above the place to be hit. The gunner's quadrant was invented in the 16th century by Tartaglia, but was unsuited for use on shipboard. The dispart sight came into use soon after the beginning of the 17th century. Notches were cut in the swell of the muzzle and in the base ring of the gun. This arrangement replaced the less exact "line of metal" method, but did not help elevation. During the War of 1812 the American officers used various sighting devices of their own design. Fixed sights were adopted in the British navy in 1801, but it does not appear that they were much better than the notches. Tangent or rear sights, which are attributed both to General Gribeauval and to Colonel Juré of the French army, did not come into use on board ship much before the middle of the 19th century.

Until near the end of the 18th century, all naval guns were fired by means of priming and a piece of match rope (slow match). Sir Charles Douglass brought out the flintlock about 1780; but it was not until after he had demonstrated its value in the *Duke*, his own ship, at Rodney's battle of April, 1782, that its importance was appreciated. In 1790 brass locks of a new pattern were applied to British naval guns, and these were used until 1818. The discovery of a composition that could be ignited by friction or percussion was made in 1807 by G. Forsyth, a clergyman. Sir Charles Douglass had designed quill primers in 1780, and a modification of these was used for the new percussion locks; but they were so slow to gain favor that flintlocks continued in quite general use for several decades. In 1828 percussion locks were fitted to the guns of the U.S.S. *Vandalia*, though they were not definitely adopted in the U.S. naval service until 1842.

**The Shell Gun.** The next important improvement was the development of the shell gun by General Paixhans, of the French army, about 1820. It was adopted by the French navy, and shortly afterward by other naval services. Paixhans predicted that shell guns would bring about the necessity for armor on ships, and his prophecy was fulfilled 30 years later. Armor (see ARMOR PLATE) in turn caused the development of the rifled gun, as an elongated projectile has much greater penetrative power per pound than a spherical one. France again led in gun development, several 6.5-inch cast iron rifles being mounted and tried during the Crimean War. They were muzzle-loading, and used studded projectiles, but they were so much more powerful than smooth bores of the

same caliber that they were at once adopted not only by France, but by nearly all the great naval powers.

**Breech-loading.** The impossibility of loading a close-fitting projectile into a muzzle-loading gun, the inaccuracy of studded shell, and the difficulty of fitting satisfactory gas-tight base rings, led to a serious re-examination of the breech-loading question.

The first breechloaders were not satisfactory. From faulty design, or material of inadequate strength, a number of these guns gave way under trial; and all were unable to prevent the escape to the rear of some of the gas. The success of the breechloader was assured by the invention of the Broadwell ring by an American army officer; this was adopted either as a loose ring or as a cup gas check by all makers; and modifications of it continued in use until De Bange invented the gas check pad, about 1880.

By 1865 smooth-bore guns had disappeared from all European navies, and by 1870 all except Great Britain and Italy were using breechloaders. The first pieces had cast iron bodies hooped with steel, but these soon gave way to forged steel built-up guns composed of a tube, jacket, and hoops. With the exception of the Krupp wedge, used in Germany, and in some other countries purchasing Krupp guns, all breech-loading guns were fitted with the French interrupted-screw breech block.

**New Propellants.** The serious defects of black gunpowder as a propellant had long been appreciated. About 1880 brown powder appeared. It was a successful propellant, as far as slow burning was concerned, and a marked increase of muzzle velocity was obtained with the same pressure; but the fouling continued. In 1887 M. Vieille brought out a nitrocellulose powder, and this was followed by numerous others containing nitrocellulose or nitroglycerine, or both. The new powders were not only more powerful, but they were comparatively smokeless, and were universally adopted. To get full advantage of the new slow burning powders, guns were gradually lengthened until about 50 calibers was reached, while the muzzle velocity of the projectile rose to 3,000 feet per second. As the velocity increased it was found that the erosion of the rifling increased with it. (See GUNPOWDER.) This was combated by reducing the powder charge and the length, and increasing the gun caliber.

**Modern Naval Guns.** In 1881 rapid fire guns were brought out, at first in calibers of 2.2 inches or less, but quickly increasing to 6 inches. The principle has now, in a measure, been extended to all calibers, though only guns in which the ammunition can be easily man-handled still preserve the name. Guns of 5-inch caliber can be loaded, aimed, and



fired at a rate of 15 shots per minute; 14 inch guns require 20 to 25 seconds per shot.

Well-made built-up guns have a transverse elastic strength of about 25 tons per square inch, and an ultimate strength (before rupture would take place) of several tons more. As the maximum service pressure is only about 15 tons, the margin of strength is ample.

The sights of modern guns are of the telescope class; but instead of a single straight tube, reflecting prisms are largely used, so that the sights may be placed in any position with regard to gun or mount. Telescope sights are much more accurate than bar sights: first, because the eye does not try to focus on three objects (the two sights and the target) at different distances; second, the object is magnified.

Turret guns are elevated, trained, and loaded by electric or by hydraulic power—in most navies the former only is used; but all the necessary operations can be performed by hand, in case of failure of the power apparatus. Guns not carried in turrets are hand operated in some instances.

Important developments in naval guns and gunnery resulted from experience gained during World War I. The range at which fleet actions are fought had been constantly increasing, as is evidenced by the Battle of Jutland, where the battle range was greater than 10 miles. There was, therefore, an increasing demand for longer and more powerful guns, which, firing at high elevations, would give the required range with a projectile capable of perforating to the vitals of an enemy ship before exploding.

**Fire Control.** Developments following the end of World War I have increased the possible angle of elevation of guns of all sizes, and have resulted in target practice at greatly increased ranges. At the same time fire control installations have all been based upon the "director," a method originally introduced by Adm. Sir Percy Scott of the British navy. Under this system the individual gun pointers and trainers keep the guns and turrets synchronized with the director, instead of actually pointing them at the target, and the guns are fired in salvos, which means the simultaneous firing of all guns of the same caliber. At modern battle ranges this form of control is absolutely necessary for the main battery guns, because the enemy ships, or targets, are actually below the horizon, and invisible from the turrets.

At the beginning of the battle or target practice the gunnery officer of the ship computes his ballistic corrections, based upon atmospheric conditions including powder temperatures. The enemy range is determined by range finders, and the course and speed of the enemy are estimated. The force and direction of the wind and the ship's own course and speed, combined with these other factors, are applied to a plotting board or automatic range-keeping machine which continues to estimate the probable range about two minutes in advance.

Using all data available the initial or ranging salvo is fired and the spotters, at the top of the masts, equipped with powerful binoculars, estimate the fall of the projectiles and advise the plotting room to increase or decrease the range, and alter the deflection to the right or left as necessary in order to bring the fall of shot on the target. This spotting continues throughout the engagement or target practice, corrections being sent down after every salvo.

With the further development of naval aviation, observation planes have been used for the spotting of gunfire. If the planes can achieve a position near the enemy battle line they are able to estimate the enemy's course and speed, and to note the fall of shot, with far greater accuracy than is possible by the spotters located in a ship's tops.

**Radar and Fire Control.** The performance of naval guns in big navies during the war 1939-45 was more effective than ever before. This added effectiveness resulted primarily from improved methods of determining range and bearing, partially the conse-

quence of improved directors and other fire control gear, but largely because of the application of radar to naval gunnery. Radar became a "seeing-eye" for the naval gunner. With radar the improvement in the determination of range and bearing was so great that the hitting efficiency of the guns was tremendously improved. In the battle of Surigao Strait, on Oct. 25, 1944, the American battleships, cruisers, and destroyers sank the Japanese fleet in the darkness without the use of searchlights, employing radar exclusively for the determination of range and bearing.

**World War II.** During the war, 1939-45, the principal guns in use in the British fleet were: 16-inch, 45 caliber, wt. of gun 103 tons, projectile 2,461 lbs., full charge of powder 640 lbs., muzzle velocity 2,953 feet per second (fps) in *Nelson* class; 14-inch, 80 tons, projectile 1,560 lbs. in *King George V* class; 15-inch, 42 caliber of *Queen Elizabeth* class, 97 tons, projectile 1,920 lbs., powder charge 428 lbs., muzzle velocity 2,450 fps; a 5.25-inch dual purpose gun used in the *King George V* class, and the *Dido* class of light cruisers; a 4.7-inch, 45 caliber gun used as an AA gun and mounted in flotilla leaders and destroyers, gun 3 tons, projectile 50 lbs., muzzle velocity 3,000 fps.

The principal guns used by the U.S. Navy during the war, 1939-45, were: 16-inch, 50 caliber guns, wt. 128 tons, projectile 2,100 lbs., muzzle velocity 2,800 fps; 16-inch, 45 caliber, 105 tons, 2,100 lbs., 2,600 fps; 14-inch, 50 caliber, 81 tons, 1,400 lbs., 2,800 fps; 8-inch, 55 caliber, 20 tons, 250 lbs., 3,000 fps; and the 5-inch, 38 caliber double purpose gun mounted in battleships, cruisers, and destroyers; also 40 mm. and 20 mm. AA guns.

#### MACHINE GUNS

A machine gun is a water-cooled or air-cooled automatic gun which because of the efficiency of the cooling system and the stability of the mount, is capable of accurate and long sustained fire at rates of 150 or more shots per minute, and this without any increase in dispersion that would endanger friendly troops over whose heads its fire may be directed. Its outstanding characteristics are: (1) A fixed platform, which (a) causes the personal equation to be removed, (b) gives close grouping, (c) makes overhead fire possible, (d) gives approximately the same result in war as in peace, and (e) permits laying and firing at night; (2) rapid production of a large volume of fire; (3) narrow front and shallow depth, features which (a) are valuable in cramped localities, (b) enable the gun to take advantage of small or isolated cover, (c) render the guns particularly valuable on outpost especially at night, and (d) offer small target to the enemy in comparison to the fire power of the gun; (4) all-around traverse, making it possible to turn the gun quickly in any direction.

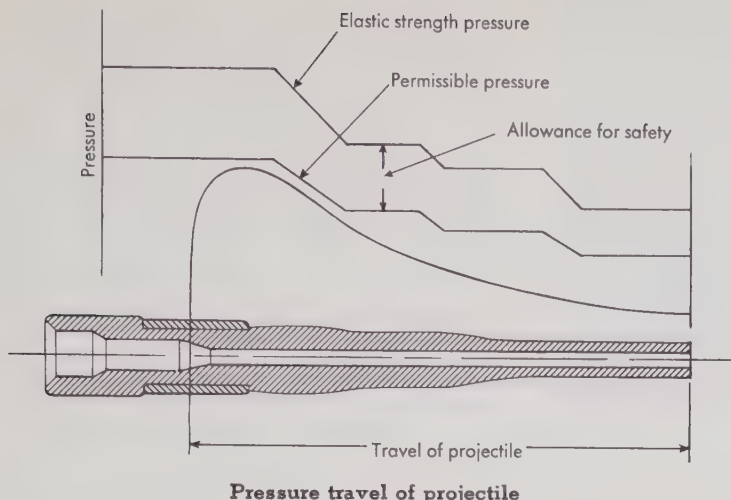
The machine guns of the present day are the result of a series of inventions beginning about 1860 though from the earliest days of firearms attempts were made to produce weapons of this kind. The oldest types of machine guns, known as *ribaudequins*, that is, organ guns, were sets of musket barrels.

**History.** The first really practical machine gun was invented by RICHARD J. GATLING of Chicago, Ill., in 1862. This gun consisted of six barrels disposed around an axis; in order to fire, it was necessary to rotate a crank by hand. A few of these guns were used in the American Civil War and the Russo-Turkish War.

About the same time as the Gatling gun appeared the *mitrailleuse*, grapeshot, which was invented in Belgium. This gun consisted of a number of barrels—25 in one type and 37 in another—and differed in principle from the Gatling in that the barrels did not rotate. The mechanism was so arranged that all the barrels were fired simultaneously. It was used by the French in the War of 1870.

Following the Gatling and *mitrailleuse* came the Gardner and Nordenfeldt type. The striking feature





extent. A .60-inch caliber machine gun was developed after World War II.

The 20 and 40 mm. guns used by the Navy on all types of ships were, likewise, machine guns, although the Navy did not commonly use that term. The Army likewise used machine guns of these sizes as antiaircraft guns. Both the 20 mm. and 40 mm. were slightly modified versions of Swedish guns adapted for antiaircraft by the British and Germans. On board ship the Navy used the 20 mm. in single mounts or twin mounts. These guns were usually elevated and trained by hand. The Navy's 40 mm. guns were sometimes used in single mounts, but more often in double mounts. Practically all of the heavier

of these guns, as compared with their predecessors, was the reduction in the number of barrels. In order to fire either of these it was still necessary to operate a crank handle or lever by hand.

In 1883 SIR HIRAM MAXIM produced the first automatic machine gun. This gun is one of the most remarkable inventions made, in that the first gun produced was practically perfect and did everything that its inventor claimed for it. The original gun weighed 60 pounds without water in the barrel casing. The principle adopted was to use a single gun barrel and to mount it so that after each shot it recoiled in its mounting through a short distance, elongating a spring which brought it back to firing position at the end of the recoil. The double movements backward and forward ejected the fired cartridge and loaded up another in its place.

Soon after Maxim had invented his automatic machine gun, which contained a single barrel, cooled by water, and which derived its motive power from recoil, Hotchkiss, a French inventor, produced a type of automatic machine gun which is air cooled and gas operated. Japan and France adopted this weapon.

The Schwarzlose, introduced into the Austrian army, is, like the Maxim, a water-cooled gun and is fed by a belt containing 250 cartridges.

In the U.S. Army the following types of machine guns and automatic rifles have been used: Gatling, Maxim, Benet-Mercie, Colt, Lewis, and Browning.

Maxim (Vickers) and Browning guns, are water-cooled, while the Lewis gun is air-cooled. The principal developments in machine gun construction since 1919 are improvements in ballistic characteristics, and increase in size and caliber. There have been experimental efforts to improve the present methods of feeding the guns, and, in general toward simplifying the pieces with a view to avoiding mechanical difficulties. All nations have attempted to perfect air-cooled guns, because of the difficulties inherent in water-cooling.

During World War I the principal offensive and defensive weapon of fighting planes was the machine gun, but, at the same time, the principal threat to attacking planes was in machine guns mounted as antiaircraft batteries. During the war an inventor synchronized the machine gun to fire through the propeller of the plane. Also, during the war most machine guns in use were .30-inch caliber. After the war .50-inch caliber guns were developed, and larger guns were developed in many countries, especially for antiaircraft defense, and as tank guns or antitank guns.

**World War II.** During the war of 1939-45 the U.S. Army used .30-inch caliber and .50-inch caliber machine guns, chiefly of the Colt and Browning types, although various modified types were used to some

types of American warships, such as most of the battleships, aircraft carriers, and cruisers carried the 40 mm. guns in quadruple mounts. The quadruple mounts were trained and elevated by electricity. The 40 mm. mounts on board ships were very effective antiaircraft guns at closer ranges. The 20 mm.'s were somewhat effective against Japanese suicide plane attacks. Battleships of our Navy carried 10 to 16 quadruple 40 mm. mounts, and 20 to 25 single or double 20 mm. mounts. Cruisers, aircraft carriers, transports, destroyers, and auxiliaries carried lesser numbers of these guns. See ANTIAIRCRAFT DEFENSES.

#### FIELD GUNS

The modern field gun of all the principal powers is the rapid-fire, long-recoil type. It differs from former types not only in its rapidity of fire—25 to 30 rounds per minute, depending upon the skill of the gun crew—but also in the fact that the gun recoils on the carriage; the recoil being checked and the gun returned to the firing position (in battery) by a recoil mechanism. This arrangement permits of rapid fire as after the first shot, which ordinarily seats the trail spade, there is practically no movement to the carriage and the gun once laid requires but little correction due to any movement of the carriage from firing. Guns may be classified according to their trajectories, i.e., the path described by the projectile in its flight. Under this classification we have the guns or flat trajectory weapons, howitzers or curved trajectory weapons, and mortars or high angle fire weapons. Each of these guns has its own use. Howitzers and mortars are to be preferred when the target to be attacked is protected by overhead cover, sheltered in trenches, or behind a relatively steep slope. Guns are used when a flat trajectory is preferable, greater striking energy, and greater range than is possible for a howitzer of the same caliber.

In all long-recoil types of carriages the gun is fastened to the recoil mechanism by means of a lug at the rear end of the gun. This lug is fastened to the piston or cylinder of the recoil mechanism. When the gun is fired the piston or cylinder is pulled to the rear with the gun and the force required to drive oil with which the cylinder is filled from one side of the piston head to the other absorbs the energy of recoil. On the periphery of the piston are cut notches. These form the orifices through which the oil must pass when the cylinder or piston is pulled to the rear. The size of the orifice is regulated by throttling bars on the inner surface of the cylinder which engage in the notches of the piston. These bars are of varying thickness, and as the gun travels to the rear gradually, they decrease the size of the orifice and bring the gun to rest. The energy stored in the compressed air or springs by the



recoil movement returns the gun to the firing position. During World War II a recoilless gun was developed which shot out a backward blast of air to remove the recoil. It produced good muzzle velocity and was an effective antitank weapon.

**World War II.** In 1917-18 the 75 mm. gun was the U.S. Army's chief heavy artillery weapon. However, the three sizes most commonly used between 1939 and 1945 were 75 mm., 105 mm., and 155 mm. They comprised the bulk of divisional, corps, and army artillery. As compared to those of 1917 and 1918 the guns were much more mobile. Very little horse-drawn artillery was used. The 75 mm. guns were drawn by trucks, whereas the 105 mm. and 155 mm. were commonly mounted on half-tracks or drawn by trucks or tractors. The Army had some larger guns, including 240 mm. guns mounted on caterpillar treads or transported by rail. Some 75 mm. guns were mounted on the chassis of medium tanks.

Other countries had field guns of corresponding sizes. Among the most notable were the British 25-pounder (comparable to the American 105 mm.), and the German 88 mm., almost as effective on the ground as it was against Allied aircraft. The American 90 mm. lacked sufficient mobility for use as a ground weapon. See **FIELD ARTILLERY**.

#### SIEGE, RAILWAY, AND COAST GUNS

The term *siege guns*, now obsolescent, formerly included guns, howitzers, and mortars. These guns were intended for attack and defense of permanent land fortifications and, because of their weight and slowness of movement, were brought to the front only when they were required to fulfill their mission and when time and road conditions permitted. Because of the use of elaborate land fortifications in Europe, the study of siege guns was far in advance of the art in the United States. Upon the entrance of that nation into World War I, the latest guns of this type were the 5-inch, Model 1898; the 7-inch howitzer, Model 1898; and the 7-inch mortar, Model 1892—firing projectiles weighing 45, 105, and 125 pounds, respectively. These guns were too immobile and possessed insufficient range for use in France.

The early wars of the United States show very marked development in the use of heavy artillery. During the Boer War the British employed 4.7-inch navy guns on improvised carriages in the defense of Ladysmith, and, as a result of their experience, had developed and manufactured a few 5-inch guns, which rendered excellent service in the early stages of World War I. In the Russo-Japanese War, the Japanese used 11-inch mortars against the powerful fortifications of Port Arthur and against the Russian ships in the harbor. The Russians dismounted a number of navy guns of about 6 inches and used them ashore.

In 1914, the Germans and Austrians startled the world by using 11- and 12-inch howitzers at Liege and Namur, and 17-inch howitzers against Antwerp. They used also a comparatively large number of guns and howitzers of a size formerly classed as siege, and, by keeping these guns with their rapidly moving forces, demonstrated that the use of heavy artillery for siege purposes only had passed. To oppose the heavy German cannon, the British had only a few 5-inch guns, and the French practically no cannon heavier than their 75 mm. The stabilized warfare which followed the invasion of France by the Germans gave both sides opportunity to strengthen their position and convert their lines into strongly fortified positions, which could not be taken except after heavy destructive artillery fire. These conditions led to increased activity on the part of all belligerents in the production of heavy or siege artillery, and this activity was further stimulated by the desire of the Germans to maintain their artillery superiority, while the French and British were impelled by the necessity of meeting the enemy artillery on an equal footing. The British continued to produce 5-inch guns and

developed a 6-inch gun, an 8-inch and a 9.2-inch howitzer. These three types were used throughout the war and were available in large numbers. The French developed a 155 mm. howitzer, a 155 mm. gun, and 220 and 280 mm. howitzers. Heavy trench mortars of about 240 mm. were used by all belligerents. Upon the declaration of war by the United States, that country arranged with her allies to secure an initial equipment of heavy artillery and at the same time began construction. The United States troops were equipped with the 155 mm. French guns, the 8- and 9.2-inch British howitzers, and a 240 mm. howitzer produced in the United States. Other guns, particularly the 5- and 6-inch, were removed from the coast fortifications and mounted on wheeled carriages for use in the field.

**World War II.** Relatively less very heavy artillery was used in World War II. The armies were more mobile, fighting took place over large areas, and extensive trench warfare was much less common than in World War I. The heaviest siege guns were used in the German reduction of Sebastopol. In general the largest army artillery was of about 240 mm., and even weapons as large as this were usually self-propelled.

**Railway Artillery.** This term includes all types of artillery normally transported on special railway carriages. During the Civil War a few mortars were mounted on railway cars, and the British experimented with light guns so mounted in South Africa, but the recent development of railway artillery is entirely due to World War I. All nations engaged made extensive use of seacoast and naval guns mounted on railway carriages. In the general type developed in Europe and employed during World War I, the gun was mounted on trunnions which permitted about 40° elevation, but traverse was obtained by sliding the carriage along a curved track. The highest state of development of railway artillery has been reached in the United States, where railway carriages have been provided for cannon as large as the 14-inch, 50-caliber gun. These carriages require but a few hours to replace and permit a 360° traverse and angles of elevation corresponding to maximum range of about 50,000 yards. The 8-inch, 45-caliber railway gun requires no preparation of position and has a range of approximately 30,000 yards. Guns of these types are equally suitable for use against land fortifications or other objects and against naval vessels, and are replacing to a large extent the fixed guns for seacoast defense.

Railway guns were used by the Germans in World War II to supplement the defenses of Normandy and in the stable warfare which characterized much of the Italian campaign.

**Seacoast Guns,** being required in permanent fortifications for defense against attacks by the most powerful warships, include some of the heaviest ordnance in use.

In the United States, the system of coast defense is as elaborate and well developed as that of any nation in the world. All classes of guns, from the largest to the smallest, are included in the armament. For defense against battleships, 8-inch, 10-inch, 12-inch, 14-inch, and 16-inch guns, and 12-inch mortars and 16-inch howitzers are installed. The 16-inch gun and 16-inch howitzer at present are the most modern standards of the major-caliber weapons. The latest 16-inch gun is a wire-wound gun, 68½ feet long. It fires a 2,400 pound projectile with a muzzle velocity of 2,750 fps; the powder charge weighs 830 lbs.; the maximum range is approximately 50,000 yards.

The latest 16-inch howitzer is also wire wound. It is 35½ feet long, and it is fired at elevations between -7° and 65°. The projectile weighs 2,100 lbs. The powder charge varies from about 100 lbs. to about 300 lbs. in weight. With the latter charge the maximum range is 25,000 yards.

For defense against light cruisers and other lightly armored ships, and for the defense of mine fields, the



## Gun Construction

6-inch gun has been installed. This gun fires a projectile weighing 108 pounds, with a muzzle velocity of 2,600 fps; and it has a rate of fire of about five rounds per minute.

### ANTI-AIRCRAFT GUNS

The U.S. Army used various guns as anti-aircraft weapons during the war of 1939-45. In addition to the machine guns mentioned above, other guns, ranging from 37 mm. to 90 mm., were used, and a gun of 120 mm. was under development at the end of the war. (See under *Naval Guns* and *Machine Guns* in this article for the Navy's use of AA guns.) The Navy's 5-inch, 38 caliber gun is a dual purpose weapon which forms the main battery of destroyers, destroyer escorts, and certain auxiliaries. The "Skysweeper," developed during the Korean War, was the first anti-aircraft weapon to have radar, computer, and gun all on one carriage. Another new feature was mobility, the carriage being mounted on wheels. See ANTI-AIRCRAFT DEFENSES.

### ANTITANK GUNS

During the war of 1939-45 the Germans set the pace in developing larger and larger guns in their tanks. Side by side with this development they used larger and larger guns as antitank weapons. Usually their antitank weapons were merely an adaptation of other guns to this particular purpose.

The United States and other belligerents followed the German's example and developed larger and larger antitank guns. Several of our standard U.S. Army guns were developed with special mountings as antitank guns, including the 75 mm., the 105 mm., and the 155 mm. F. H. S.

### ATOMIC CANNON

Among the important atomic weapons developed after World War II was the 280 mm. atomic cannon. Although its weight was 85 tons, it proved capable of speeding over highways at 35 miles per hour, navigating rough country, and being transported in landing ships for amphibious operations. Success of the atomic cannon was established in the spring of 1953 when the first atomic shell ever to be fired was shot seven miles over the desert near Frenchman Flat, Nevada, and exploded 500 feet over the target as scheduled.

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**GUN CONSTRUCTION.** There are two types of heavy guns, *monobloc* and *built-up*. Monobloc or single-piece guns are made of high strength steel or medium strength steel *autofrettaged*. Built-up guns are of two kinds; (a) guns with initial bore compression obtained by shrinkage, the exterior parts being heated to go over the interior, and (b) the "wire-wound" gun. The parts comprising a built-up gun are called the *liner*, *tube*, *jacket*, *hoops*, *locking rings*, *trunnion rings*, *wire winding*, etc. A gun may be considered as a tube designed to withstand a given pressure from within. In constructing such a tube, the first consideration is what pressure it will have to withstand throughout its length, and then to make it strong enough to resist that pressure with an adequate factor of safety.

Considering the gun as a hollow cylinder, the two principal stresses to which such a cylinder is subjected upon the burning of the powder charge are, first, a circumferential or *tangential stress* or tension, coupled with a *radial stress* tending to split the gun along its length; and second, a *longitudinal stress* tending to break the gun in a transverse direction. In modern guns this longitudinal stress is of small magnitude.

In a simple hollow cylinder under internal pressure, the metal at the bore has a greater percentage of stretch than the outer surface, and this elongation or stretch decreases from the inside to the outside. This means that in a simple cylinder a limit is soon reached



U.S. WAR DEPARTMENT O. C. O. JOHNSTON & JOHNSTON PHOTO

**Gun Tube** is made from a solid cylindrical blank of steel which is centered, then rough turned on lathe

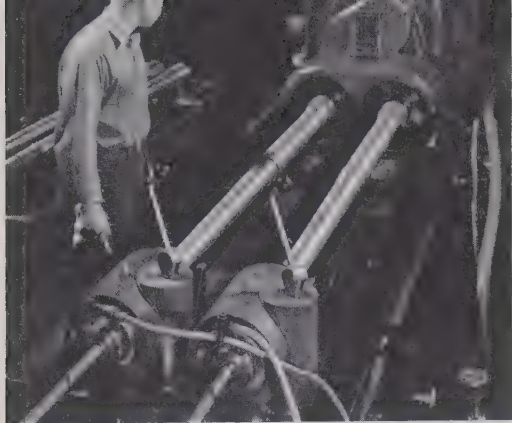
beyond which an increase in wall thickness adds but little to the elastic resistance of the cylinder. With a wall thickness equal to one-half the bore, the cylinder is nearly as strong as if it were from 5 to 10 times as thick. With a wall thickness of infinity, the maximum pressure that the cylinder would withstand without permanent enlargement of the bore is but 75 per cent of the elastic limit of the metal. Hence a gun made in this manner of medium strength steel would not withstand the powder pressure.

To obviate this condition, a method must be devised to compel the outer layers of the forging to carry a greater proportion of the stress. There are two methods of doing this, and they are the system of *varying elasticity* and the system of *initial tension*. A gun constructed by the system of varying elasticity would be made of layers of metal, the layer nearest the bore having the greatest elasticity, so that when subjected to a bore pressure the inner layers, in resisting the pressure, dilate sufficiently to carry a due proportion of the stress to the outer layers. Since guns built by this method must be made up of layers of different metals, this type of construction is impracticable.

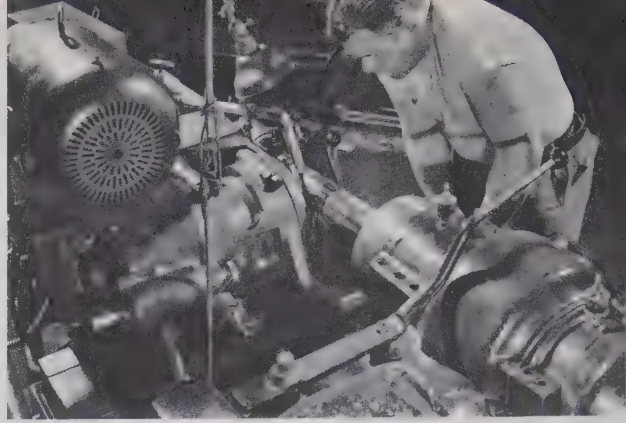
Using the system of initial tension, guns are built of layers of metal in which the outer layer is brought into a state of tension which in turn sets up an initial compression in the metal nearest the bore, so that when pressure is applied to the bore, the inner layers must be stretched enough to remove the initial compression before they experience a tension. All built-up guns are, therefore, made by the system of initial tension. There are two methods of this system in use, exemplified by the wirewound gun and the plain built-up gun made by shrinkage process.

Steel forgings manufactured prior to World War I had an elastic limit of 65,000 pounds per square inch. This led to use of *wire winding* to increase the gun strength. The wire, of square or rectangular cross section, is wound around an inner tube of steel. Each layer of wire is wound with a uniform tension of wire, and each layer of wire exerts a compression on the layers which are inside it. The wire having been wound in place, the gun is finished with an outer hoop or hoops of steel shrunk over the wire. Since wire can be made with an elastic limit of 200,000 pounds per square inch, this type of gun can be made strong in comparison to its weight. This was a very satisfactory method of making guns up to 35 or 40 calibers in length, but since the wire winding gives no strength in the longitudinal direction, guns of 50 or more calibers in length lack stiffness and droop excessively. Hence most guns of built-up construction are manufactured of forgings assembled by the shrinkage method.

In *built-up* guns, the jacket and chase hoops are shrunk on the tube, which extends the full length of the gun; other hoops are shrunk over the jacket and



**Gun Cylinders**, rough turned on lathes, are mounted and bored two at a time on horizontal boring mills



U.S. WAR DEPARTMENT O. C. O. JOHNSTON & JOHNSTON PHOTOS

**Spanner Threads** are cut around outside of tube by machine after bore of the tube is finished

chase and, finally, the liner is shrunk inside the tube. Large guns are composed of as many as four or five layers at the breech end.

**Autofrettage or Self-hooping**, a new method of gun construction, was developed during and subsequent to World War I. It is sometimes designated as *radial expansion*. Metals are elastic within certain limits, and up to this limit there is a direct proportionality between the applied load and the stretching of the material. If a stress is applied within this elastic limit, the metal will return to its original dimensions upon release of load. If the load is increased when the elastic limit has been reached, this proportionality no longer holds and the metal will yield and suffer a comparatively large strain without increase in stress. Further increase in load will increase the strain. The metal has received a permanent set, but if the load is released it will attempt to return to its former dimensions.

This property of metal is taken advantage of in construction of guns by *autofrettage*. Gun forgings are expanded by means of hydraulic pressure in the bore, the forging is machined with the bore somewhat less than the finished dimensions, and additional metal is also left on the outside. The bore is sealed at the breech and muzzle ends by suitable packings, and pressure is applied until the metal at the bore is brought to its elastic limit and then further increased until the desired amount of cold-working is done.

In guns manufactured for the U.S. Navy, pressures are applied until the outer layer of the forging just reaches its elastic limit in strain, but French practice is to apply further pressure so that the metal is cold-worked to such an extent that the bore receives a permanent set of approximately 2½ per cent. The U.S. Army applies such pressures as will permanently enlarge the bore by as much as 6 per cent. These autofrettage pressures, varying from 40,000 to 100,000 pounds per square inch, are considerably greater than the powder pressure which the gun will be called upon to resist when it is fired.

**Centrifugal Castings.** Most guns are made from steel forgings, but some U.S. Army medium caliber guns are made from centrifugal castings. This process, developed between the two World Wars, involves pouring the molten metal into a chill mold that is rotated at a high speed, so that the centrifugal force causes the metal to take the shape of the mold before it solidifies. The casting is removed from the chill mold as soon as it is solid and rigid enough to keep its shape during handling. When removed from the mold the hot casting is cooled slowly in cinders or in a furnace to obtain a more crystalline structure of the metal. It is then given a normalizing and annealing treatment, and machined internally and externally. The casting is then quenched and drawn, the heat treatment being similar to that of a gun forging.

Special purpose guns, such as those mounted on submarines are sometimes made of nickel-copper

alloy forgings, or of steel tubes with shrunk-in nickel-copper alloy liners.

**Rifling.** The gun is now ready to be rifled. Rifling consists of a number of helical grooves cut in the bore of a gun, beginning in front of the powder chamber and extending to the muzzle. The lands are the surfaces of the bore between the grooves. The twist of the rifling is the inclination of a groove to the element of the bore. It may be *uniform* or *increasing* or a combination of the two. In uniform twist the degree of twist is constant from the front of the chamber to the muzzle. In increasing twist the degree of twist increases from zero or a small value at the origin to a sharper twist at the muzzle. Rifling is performed in a machine which is similar to a boring lathe except that the gun is held stationary and the rifling bar, which takes the place of the boring bar, has a spiral slot cut on its surface, the pitch of which corresponds to the twist of the rifling to be cut in the gun. The rifling tools are carried in the rifling head, which consists of a hollow body with a tapered shank for attachment to the rifling bar, and a brass sleeve which is made slightly less in diameter than the finished bore of the gun. T-slot guide grooves are provided in the forward end of the body for the support and accurate spacing of the cutters. The number of cutters is usually one-half of the number of grooves to be cut in the gun. The depth of rifling is approximately 1 per cent of the bore diameter. Small guns are sometimes rifled with broaches. Several broaches are needed to give proper depth and form to the rifling, but each broach will cut all the grooves at one time and complete its portion of the work in one pass.

**Relining.** After firing a considerable number of shots a gun loses its accuracy. This is due to enlargement of the bore from the scouring action of the hot powder gases. To restore its accuracy the gun must be relined. Because of the taper of the outside diameter of the liner, it is possible to withdraw the worn-out liner and insert a new one in its place. To withdraw the liner its breech and muzzle ends are threaded. A plug with water connections is screwed in the muzzle threads and pulling rigging screwed in the breech threads. The gun is placed in the furnace, muzzle end down, and heated to a temperature of approximately 600° F., when cold water is introduced in the bore through the muzzle fitting. This causes the liner to contract away from the walls of the tube. The liner is unseated by the pulling rig and then lifted out by a crane. The new liner is assembled in the same manner as previously described. Smaller guns have liners that can be removed and replaced quickly in the field. This time saving is of great advantage. See GUNNERY; GUN.

BIBLIOG.—T. J. Hayes, *Elements of Ordnance* (1938).

**GUNBOAT**, a small vessel armed with one or more heavy guns. With its light draught it is able to run close inshore or up rivers that are too shallow



for vessels of greater displacement. Boats of this type have long been a part of most navies. They are used chiefly for patrol duty, but in the American Civil War gunboats took part in many engagements on the Mississippi River.

In the U.S. Navy such vessels are of two classes: gunboats displacing more than 1,000 tons and used chiefly for coastal patrol; and river gunboats of the smaller and of lighter draught. The U.S. gunboats of the smaller type are used principally on the Yangtze River, in China. One of these, the *Panay*, was sunk by a Japanese bombing attack in 1937. Others were captured by the Japanese in 1941, shortly after the outbreak of World War II. Gunboats are used extensively by the British navy in Egypt, China, and India.

**GUNCOTTON, CELLULOSE NITRATE, or NITROCELLULOSE**, a powerful explosive produced by the action of strong nitric acid on ordinary cotton. Guncotton was discovered by Pelouze in 1838 but was not fully developed or understood until Schönbein began his experiments with it, the results of which he published in 1846. It has been studied by many chemists, but they are far from agreement as to its exact composition or chemical status.

The most highly nitrated form of guncotton is believed to be expressed by the formula  $C_{24}H_{28}O_{20}(NO_2)_{12}$ . Very highly nitrated nitrocellulose (containing over 12.75% nitrogen) is insoluble in a mixture of alcohol and ether at ordinary temperatures, and by many authorities this, and this only, is designated as *guncotton*. Cottons of fairly high nitration, but soluble in ether-alcohol, are used in the manufacture of those gunpowders that contain no **NITROGLYCERIN**. These and other cottons of somewhat less nitration are called *collodion cottons* and are largely used in the manufacture of celluloid. Cottons of low nitration, called *friable cottons*, are of little use except in mixtures with higher grades. Like the true guncottons, the friable cottons are insoluble in ether-alcohol. The dividing line is approximately 11.1 per cent nitration. The true guncottons, while insoluble in a mixture of ether-alcohol, are soluble in acetone and other ketones, ethyl acetate, and other solvents. When first made, guncotton and collodion cotton greatly resemble the cotton from which they are made but are slightly harsher to the touch. The friable cottons look very different while forming. They dissolve in the acid and are collected in the form of a paste.

Guncotton used as a blasting or disruptive explosive contains about 25 per cent of water and is ordinarily stored in airtight cases. If properly made, it is, in the wet condition, the safest explosive known, the necessary care in handling being only such as will avoid injury to the metal containers. In this condition it is readily detonated by a fair-sized primer of dry guncotton set off by a fulminate exploder.

Both guncotton and collodion cotton, after being dissolved, may be "colloided" by evaporating the solvent. In this condition they resemble celluloid, gelatin, or glue, are nearly insensitive to shock, and are not easily ignited except by a suitable primer or hot flame.

*Commercial guncotton* is usually a mixture of soluble and insoluble nitrocellulose. It is not necessarily less stable on this account, but it may be; and if stored for any length of time it should be kept wet (25 per cent water) in airtight containers. Nearly all nitrocelluloses when first made contain cottons of various degrees of nitration. The varieties not needed are removed by the use of suitable solvents. See **EXPLOSIVE; CELLULOSE**.

E. C. B.

**GUNDELIA**, a one-species genus of Asiatic composite plants. *G. Tournefortii* has thistle-like leaves and large, handsome purple flowers.

**GUNMETAL**, so called because of its use for the manufacture of ordnance before the introduction of steel for that purpose, is an alloy of copper (88 per

cent), tin (8 per cent), and small quantities of zinc and lead. It is cast in green-sand or dry-sand molds; and careful attention to the casting temperature, and to the rate at which the casting is cooled in the mold, is essential in order that the various constituents and their compounds may not separate. Gunmetal is a tough metal of a dull color, and is used in the construction of valves, steam regulator slides, and other work where strong, durable castings are required. It is also used extensively in the manufacture of jewelry, especially cigarette cases, umbrella handles, and watch cases.

**GUNNEL**, a genus of coast fishes. One species (*Pholis gunnellus*), the spotted gunnel or butterfish, is common on British coasts, lurking under stones in tidal pools. The color is deep olive, with a dorsal row of black spots surrounded by white rings; the usual length is about six inches; the skin is thickly coated with a mucous secretion.

**GUNNERY** is the science and art of handling guns. It consists of gun strategy and tactics, fire control, interior and exterior ballistics, and an investigation of the problems connected therewith.

**Gun Strategy and Tactics** involve a study of the means of gaining all possible advantages due to methods of mounting and placing guns, direction in which it is desirable to bring the enemy as regards the sun, sea, land, arc of fire, range, etc.—in fact, a study of all means of making the most of your own weapons and minimizing the effect of those belonging to the enemy.

**Fire Control** is of importance primarily when the target is not visible from the gun, such as in long-range naval battles, or in land actions where artillery is defiladed from its objective. In such instances fire must be directed from a third point, from which the target can be seen. The fire of artillery in land warfare is usually directed from an observation post, where firing data are calculated on the basis of a point visible or known to the gun crew, and the necessary offsets determined. The fire of naval guns is usually controlled from a director tower, where there is located a master sight carried on a mounting trained and elevated like a gun mounting. The position of the enemy is plotted with the aid of range finders and other instruments, including radar. The director is trained constantly to the position based on the latest calculations, and its motion is transmitted to the direction and range controls of the guns, all of which follow the motions of the director or master sight. Actual observation of fire is made from spotting towers, or in some cases by observation planes. The first objective of artillery fire, both land and naval, is to bracket the target with salvos or single shots. The bracket is then diminished to obtain the greatest proportion of hits.

**Interior Ballistics** treats of the phenomena occurring in a gun, which may be regarded as a heat or internal combustion engine in which the projectile acts as the piston. The object of the gun is to give the projectile the highest velocity practicable within a permissible limit of strain upon the gun and its mount, and with a minimum of wear, erosion, and other objectionable results. The efficiency of the powder is measured by its behavior in these points. See **BALLISTICS**.

**Exterior Ballistics** treats of the phenomena of the flight and impact of projectiles. See **ANTI-AIRCRAFT DEFENSES; ARMOR PLATE; FIELD ARTILLERY; GUN**.

**GUNNISON RIVER**, Colorado, rises in the Rocky Mountains and after a meandering course joins the Colorado River at Grand Junction. The magnificent rock-wall canyons through which the river flows are included in **BLACK CANYON OF THE GUNNISON NATIONAL MONUMENT**, an area of 12,040 acres set aside in 1933. Water for irrigating a vast region of the Rockies and particularly the Uncompaghre Valley is diverted through the Gunnison Tunnel, a bore 30,582 feet long through Vernal Mesa, opened in 1909.

**GUNNY BAGS** are made of a coarse jute fabric (see **JUTE**), and are very largely exported from India to various parts of the world. American cotton is largely packed in these. About 1850 the making of gunny bags was the great domestic industry of lower Bengal, giving occupation to men, women, and children of nearly every class. Now, however, the manufacture is almost entirely carried on in large factories, of which there are about 50 in India, employing over 125,000 persons. Cloth and bags of the same kind are made in Dundee, Scotland.

**GUNPOWDER** is the explosive used in guns to give the propelling force to projectiles. Three varieties have been in use—black, brown, and smokeless.

The early history of black gunpowder is unknown. It is said to have been used by the Chinese several centuries before it became known in Europe, but there is no direct proof of this. In fact, modern research indicates that the Chinese had no gunpowder until it was introduced from Western Europe. It is probable that it was a development, not a discovery. As early as the seventh century an incendiary composition called "Greek fire" was used in the navy of the Eastern Empire. Its composition was a secret, but according to many writers it consisted of salt, sulfur, pitch, rosin, and oil. Not far from Constantinople crude saltpeter and crude petroleum were to be found on the surface of the ground, so it is not unlikely that these two substances formed the "salt" and the "oil." This combination was both flammable and explosive. Among the many ways in which it was used, a favorite one in later days was to pour it through tubes in the bows of the galleys upon the decks of the enemy's vessels at the moment of ramming. The mixture was apparently put in a cuplike charging piece and touched off by some sort of flame. It is significant that these tubes and charging pieces closely resemble the earliest known guns—which were all breech-loaders—and that the composition of the material contains all the elements of gunpowder. The definite preparation of a dry powder was a development which produced the real gun. Its first mention as a powder is by Roger Bacon in the latter half of the 13th century. During the next 600 years the principal changes were variations in the proportion of the ingredients, granulation, and other perfections of manufacture.

The essential element is niter. The first undisputed mention of the substance we now call saltpeter or niter is found in the writings of the Arabian author, Abd Allah (born about A.D. 1200), who calls it "Chinese snow." The word "niter" was used before and during this period to designate soda. It is uncertain how long the Chinese had known niter before this period, but it seems evident that they were not familiar with the use of gunpowder as a propellant or as a blasting agent, although they used saltpeter mixtures in rockets and "roman candles" as early as the 10th century A.D., and possibly earlier. That they did not know cannon seems certain from the fact that Marco Polo does not mention them, and they were frightened by the firing of three pieces of ordnance which the Portuguese of Macao presented to them.

**The Friars.** In England, Friar Roger Bacon (1214–94) is generally credited with the invention of gunpowder. In the work in which he makes his defense against accusations of witchcraft (1242) he gives explicit directions for the purification of saltpeter, to which he refers as a little known and comparatively new substance. He wrote his directions for making "a thundering noise and bright flash" in the form of a cryptogram which has been translated as "let the total weight (of the ingredients) be thirty. However, take of saltpeter seven parts, five of young hazelwood, and five of sulfur; by these you will produce a thundering noise and a bright flash if you know the trick. You may find (by actual experience) whether I am writing riddles to you, or the plain truth." But, in this work Bacon does not show any attempt to use

his gunpowder as a propellant or for blasting. Apparently he knew then only that it would explode and frighten people.

In Germany, another friar, Bishop Count Albert of Ballstadt (1193–1280), better known as Albertus Magnus, mentioned the peculiar properties of a powder made from saltpeter, sulfur, and charcoal, which would create thunder and lightning and cause rockets to rise. Probably the "powder monk," Berthold Schwarz, got his first knowledge of powder from the writings of Albertus Magnus.

Schwarz is often mistakenly called the inventor of gunpowder, but he is generally admitted to be the inventor of firearms. The dates of his inventions and the details of his life are uncertain. The parchments on which he wrote in the monastery of Freiburg were later scraped to make them available for the writing of later records. However, it seems probable that he invented firearms in the year 1313. Shortly thereafter, firearms appeared in different countries.

**Early Use in Warfare.** Besides its use in firearms, gunpowder was soon applied to the mining of the walls of fortifications. The earliest authenticated attempt of this kind was at the siege of Pisa, in 1403, when it was planned to fill a secret passage under the walls of the town with powder and explode it. This plan was betrayed. Descriptions of land mines are found in the *Bellifortis* of Konrad Kyeser of Eichstadt (1405) and in the writings of the Italian military engineer, Taccola (between 1429 and 1449). Even infernal machines made their appearance quite early. Veit Wulff von Senftenberg, writing in the 16th century, describes a death letter which was to be filled with an explosive substance and sent to one's enemy.

**Black Powder.** The composition of black powder has varied greatly from time to time. For instance, in the middle of the 15th century a mixing bowl was charged with 15 or 20 pounds of the weighted materials, which were moistened with a little water, vinegar, or urine. The urine of a wine-drinker was reputed to make the best and strongest powder. Today the composition of black powder varies as follows: Niter ( $\text{KNO}_3$  or  $\text{NaNO}_3$ ) from 62 to 75.7 per cent; sulfur from 10 to 19.4 per cent; charcoal from 5 to 12 per cent.

Black powder was not displaced as the principal propellant until about 1880, although experimental smokeless powders were used as early as 1846. The advantage in a slow-burning powder had long been realized. It was readily seen that if a powder were to generate its gases slowly enough the volume of gases could be greatly increased by adding to the weight of the charge, and then, by lengthening the gun the velocity of the projectile could be much augmented without increasing the maximum pressure in the bore.

Experiments for the improvement of the existing black powder whereby its rate of combustion could be diminished led first to enlarging and hardening of the grains, and slightly changing its composition. The final result was a brown, or cocoa, powder. This contained less sulfur and more carbon, and the carbon was of wood which had been incompletely charred, and not fully dehydrated. This brown powder left more residue in the gun than black powder, and nearly as dense a smoke.

Black powder which is intended solely for blasting purposes usually has more sulfur than that which is used in guns. The decrease in the amount of charcoal and the corresponding increase of sulfur accelerates the rate of burning, and adds considerably to the blasting effect. In addition to blasting purposes, black powder is still employed in fireworks, shell charges, primer compositions, and ignition charges for smokeless powders. It is no longer used as a propelling charge in any military arm, and its use in shotguns is comparatively small.

**Smokeless Powders** are almost wholly of two types: (1) those composed solely of nitrocellulose,



with or without a stabilizing agent; and (2) those composed of nitrocellulose and nitroglycerin, with the addition of vaseline, and, in some cases, of small amounts of other substances. Some powders, used solely in small arms, have certain oxygen-bearing salts in addition to the nitrocellulose, or nitrocellulose and nitroglycerin.

Pure cellulose powders are more stable, less liable to variations due to temperature, and are much less erosive in the bore of the gun. Powders containing much nitroglycerin, when stable and kept under favorable conditions of temperature and moisture, give very regular pressures, are easily ignited, weigh less, and cost less than pure nitrocellulose powders; but they are very susceptible to changes of temperature—which affect both stability and regularity of pressure—and they are exceedingly erosive in the bore. See GUNNERY.

All smokeless powders are “colloided” or turned into a substance resembling zylonite, gelatin, or celluloid. This is necessary in order to reduce the rate of burning and avoid excessive variations due to moisture. The form of the colloid is either a slender rope, cylindrical grains, or flakes. Certain nitroglycerin mixtures have the rope form, and are called CORDITE in consequence. Nearly all the pure nitrocellulose types have cylindrical grains pierced longitudinally with several holes parallel to the axis of the cylinder. This perforation enables the combustion to go on at a rapid rate. If a grain burned only from the outside, the rate of burning would decrease nearly in proportion to the surface exposed, which, as the grain burned, would be constantly lessening.

The value of smokelessness is great in all classes of guns, but it is possibly greater in small arms. It not only assists at concealment, but the lack of solid residue prevents fouling of the bore, and makes practicable the small caliber of rifle now generally used.

J. B. HEFFERNAN

**GUNPOWDER PLOT**, a conspiracy to blow up the British Houses of Parliament on Nov. 5, 1605, when King James I was to open Parliament in person. A number of Roman Catholic country gentlemen seem to have been connected with it; but the ruling spirit was Robert Catesby, who had already suffered for the part taken by him in Essex' plot. Early in 1604 Catesby communicated his plan to John Wright and Thomas Winter. GUY FAWKES, a soldier serving in the Spanish Army, was brought over from Flanders, and together with Thomas Percy was admitted to the plot after taking an oath of secrecy. On May 24 Percy hired a room adjoining the Parliament House which they intended to undermine. In December the digging was begun. The difficulties were greater than was expected, and it became expedient to call in the assistance of fresh associates—John Grant, Robert Winter (brother of Thomas), and Bates, a servant of Catesby.

In the following March the conspirators were able to hire a convenient cellar immediately below the House of Lords. The mine was now abandoned, and the cellar stored with casks of powder, covered with fagots.

Wishing to save his friend Lord Monteagle, Francis Tresham, who had been induced to join the conspirators, wrote to him on Saturday, Oct. 26, a mysterious letter, which was shown to Lord Salisbury, and which led to the discovery of the plot. A little before midnight, Nov. 4, 1605, Fawkes was arrested in the cellar. Catesby hastened to Warwickshire, hoping to raise his friends. A few days later they were attacked; several of the conspirators, including Catesby, were killed, and others were taken prisoners and committed for trial. From their confessions the whole plot was gradually revealed. Bates' confession implicated certain Jesuit fathers, especially Garnet and Greenway.

The plot is commemorated in the annual searching of the vaults below the Houses of Parliament at the opening of each session, and in the celebration of Guy Fawkes Day (Nov. 5). During the latter, which corresponds roughly to America's Halloween, scarecrow effigies of Guy Fawkes, stuffed with combustibles and known as “guys,” are paraded through the streets by processions of boys, and then tossed into a bonfire.

**GUNSAULUS, FRANK WAKELEY**, 1856–1921, American Congregational clergyman, was born in Chesterville, Ohio, studied at Ohio Wesleyan University, and was ordained a Methodist minister in 1875. Four years later he transferred to the Congregational ministry. As pastor of the Plymouth Church, Chicago, he met Philip Danforth Armour and together they founded Armour Institute in 1893. In 1919 Gunsaulus resigned his pastorate to devote all his time to the school. From this year until his death he lectured throughout the United States and at one time was a professorial lecturer at the University of Chicago, to which he donated his collection of rare manuscripts. To the Chicago Art Institute he gave his Wedgwood and Near-Eastern pottery collection, which is now housed in a special Gunsaulus Gallery at the Institute. The wide range of Gunsaulus' interests is indicated by the subject matter of his books which include: *Transfiguration of Christ* (1886); an historical novel of the Renaissance, *Monk and Knight* (1891); *William Ewart Gladstone* (1898); and *The Higher Ministries of Recent English Poetry* (1907).

**GUNSHOT WOUNDS** have certain characteristics due to the fact that they are deep, penetrating wounds made by a projectile which travels at high velocity and strikes with great impact. In the cast of soft bullets and certain mutilated types of bullets known as “dumdum,” the impact is accompanied by a spreading of the bullet and a lacerating as well as penetrating effect. A further characteristic of a gunshot wound is that infection is frequently introduced into the tissues with bits of skin and clothing

which may be carried along by the bullet. The bullet, having been subjected to heat in the process of firing, is not in itself a source of infection.

The importance of a bullet wound depends upon where in the body it is sustained. If a bullet merely passes through or is imbedded in soft tissues, such as muscles or fat, it causes what is popularly called a “flesh wound,” which may do very little harm except to cause bleeding, pain, and local inflammation. The wound is more serious if the bullet shatters a bone or if it causes severe hemorrhage by lacerating arteries or veins, or produces paralysis by cutting a nerve. See article WOUND.

ET GENTLICHE ABILDUNG NIT ETTLICH ENGLISCHE EDELLEUT EINEN RAUF  
schließen den König samt dem ganzen Parlament nutzlos zu zerstören.



FROM "THE TRIAL OF GUY FAWKES"

Group of conspirators in Gunpowder Plot. An anonymous drawing

In the abdomen the most serious consequences of a bullet wound arise from injury to large blood vessels, with massive bleeding, or from the perforation of the intestine, permitting the contents to infect the peritoneal cavity. If there is injury to the liver or spleen slow bleeding may result. In the chest a bullet wound which pierces the heart is almost immediately fatal, but bullet wounds which injure without piercing this organ have been surgically repaired. Gunshot wounds involving the lungs vary in seriousness, depending on whether large blood vessels have been injured, with resulting hemorrhage.

Gunshot wounds in the head and neck are more likely to be serious than elsewhere in the body because of the closely packed relationship of vital structures present in this region. Injuries to eyes, ears, nose, mouth, or brain may either be rapidly fatal or have long-lasting consequences, such as blindness, etc. In the neck, injury frequently occurs to the large arteries, veins, or nerve trunks, to the esophagus, the larynx or trachea, or to the thyroid gland.

**Treatment** for gunshot wounds depends upon the location and upon the amount of hemorrhage. If there is severe BLEEDING it must, of course, be controlled at once; otherwise the wound may be treated as in the case of any other deep penetrating wounds by simple dressings and the administration of a prophylactic dose of TETANUS antitoxin. Probing for the bullet is seldom an immediate necessity. Popular conceptions of the importance of removing bullets are usually exaggerated. There are many times when it is better to leave the bullet where it is, at least until there has been time for repair of the damaged tissues and opportunity to estimate the extent of the damage and what restorative surgery, if any, may be necessary.

In the case of gunshot wounds involving the abdomen, immediate surgery is almost always essential for the purpose of controlling hemorrhage, and of repairing the perforated bowel, and providing drainage and treatment for the peritoneal infection. The use of sulfa drugs, penicillin, and related drugs in the case of abdominal gunshot wounds has greatly improved the likelihood of recovery by reducing the occurrence of serious infection.

Bullet wounds of the chest usually require very little except rest and the use of morphine or other

sedative drugs to reduce breathing activity to the minimum. When gunshot wounds of the brain are sustained, the procedure depends upon the condition of the patient. Usually rest is prescribed, unless there is evidence of continued hemorrhage, as indicated by the rise of pressure within the skull. In such a case it may be necessary to remove a portion of the skull in order to release pressure. If the bullet can be accurately located by x-ray and can be removed without causing further injury, this is usually done.

When the patient has recovered from the immediate danger of shock, hemorrhage, and infection, steps can be taken to remove the bullet if it has not already been removed. Unless presence of the bullet is causing inflammation or irritation, the decision of the surgeon may be to leave it where it is, particularly if it is so located as to render surgery hazardous. For locating a bullet the x-ray is used according to the same method practiced by surveyors and astronomers, namely triangulation. W. W. BAUER, M.D.

**GUNTER, EDMUND**, 1581–1626, English mathematician, was born in Hertfordshire, and became professor of astronomy at Gresham College, London (1619). He invented "Gunter's chain," used in land surveying; "Gunter's line," "Gunter's quadrant," and "Gunter's scale"; he also published a table of *Logarithmic Lines and Tangents* (1620), and introduced the expression "co-sine" and "co-tangent." He also discovered the variation or changeable declination of the magnetic needle. To his friend Briggs he suggested the use of the arithmetical complement.

**GÜNTHER, HANS**, 1891– , German physical anthropologist who provided "scientific" sanction for Nazi racist policies. He directed a detailed physical anthropological study of the German population seeking for purity of racial type with homogenous and isolated settlements of German peasants. He wrote a racist *Anthropology of the German People*.

**GÜNTHER, JOHANN CHRISTIAN**, 1695–1723, German poet, was born in Silesia. A poem on the Peace of Passarowitz won him recognition, and he wrote a number of graceful lyrical poems, tinged somewhat by bawdiness and Bohemianism. His dissolute habits earned him the disapproval of those who might have furthered his career, and intemperance shortened his life. His collected poems were published in four volumes (1723–35).

**GUNTHER, JOHN**, 1901– , American author and journalist, was born in Chicago, Ill., and was educated at the University of Chicago. After working as a reporter on the *Chicago Daily News*, he went abroad in 1924, serving as correspondent in nearly every large European capital, as well as in the Orient and Near East. He wrote a number of novels, as *The Red Pavilion* (1926) and *Troubled Midnight* (1945), but is best known for intimate, anecdotal reports on political trends. These include *Inside Europe* (1936), *Inside Asia* (1939), *Inside Latin America* (1941), *Inside U.S.A.* (1947), *Behind the Curtain* (1949), *Roosevelt in Retrospect* (1950), *Riddle of MacArthur* (1951).

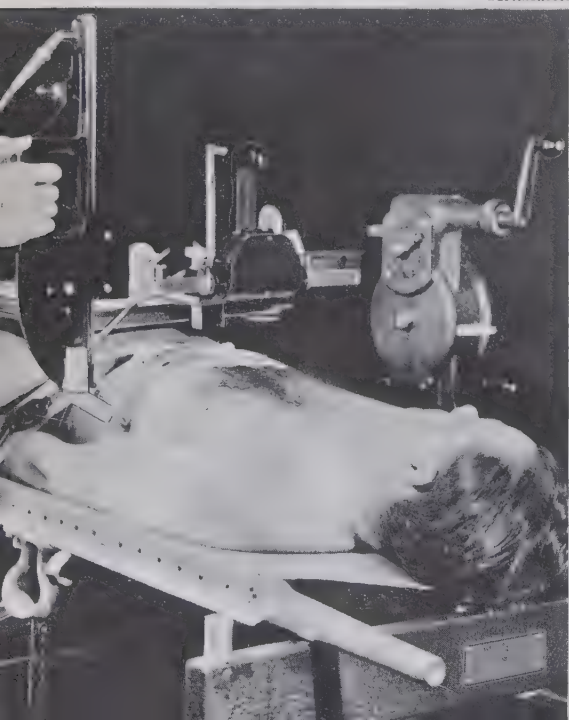
**GUNTON, GEORGE**, 1845–1919, American economist, born in Cambridgeshire, England, came to the United States in 1874. In 1890 he was president of the Institute of Social Economics, and in that year became editor of the *Social Economist*, the name of which was changed in 1896 to *Guntton's Magazine*. He was appointed international examiner and director of the economic and sociological work of the Y.M.C.A. in North America in 1899. He wrote *Principles of Social Economics* (1891) and *Trusts and the Public* (1899).

**GUNTUR**, city, India, Madras Province, capital of Guntur District, 70 miles W of Masulipatam. It is a railway and highway junction, has manufactures in cotton textiles, tobacco, oil, and rice, and is an increasingly important trade center. A college and a training school are located here. Pop. (1941) 83,599.

**GUPPY**, *Lebistes reticulatus*, is a small, brightly-colored fish native to Venezuela and Trinidad. It is imported to the United States for use as an

Location of bullet in a wound by x-ray device

WESTINGHOUSE





AQUARIUM fish. The female is larger than the male, and brings forth her young alive. Guppies are useful in the control of mosquitoes, upon whose larvae they feed. See FISH, TROPICAL.

**GURGAN**, formerly Asterabad or Astrabad, town, N Iran, in the Second Province, at the foot of the Elburz Mountains, about 25 miles SE of the Caspian Sea and 185 miles NE of Teheran. Because of its strategic position Gurgan was formerly a political center and a chief point on the caravan routes. The Kajar dynasty originated here. There is trade in rice, cotton, and carpets. Pop. about 20,000.

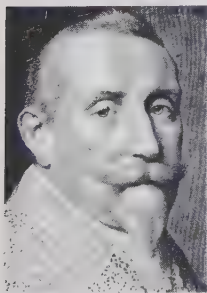
**GURKHAS**. See GHURKAS.

**GURNARD**, a widely distributed spiny fish belonging to the family *Triglidæ*. Several species inhabit the North Atlantic coasts, the more important being the gray gurnard, *Trigla gurnardus*, the tub or latchet, *T. hirundo*, and the red gurnard, *T. pini*. Gurnards live upon crustacea such as small crabs and shrimps, also upon fishes and echinoderms. They spawn in summer, the eggs being buoyant or pelagic. The gurnards have the power of emitting a faint, grunting sound, produced in the air bladder. They are much used as food in England, but not in America.

**GUSTAVUS I VASA**, 1496–1560, king of Sweden, was born in Lindholm in Upland. He bore the Swedish standard at the Battle of Brännkyrka (1518) when Sten Sture defeated Christian II of Denmark, and was one of the hostages on the Swedish side during the ensuing negotiations. He was, however, treacherously carried off by the Danes and imprisoned at Kalb, near Aarhus in Jutland, but escaped. Utilizing the national indignation at the Stockholm "blood-bath," he incited the peasantry of the Dales (Dalecarlia) to rise in revolt at Mora (1520). He drove out the Danes, and was proclaimed king by the Parliament of Strängnäs in 1523 and ruled until his death. After securing himself against restoration projects from the Danish side by the treaty of Malmö (1524) with Frederick I, he determined to strengthen the monarchy by putting down the wealthy hierarchy and introducing the reformation. The reformation was carried through at the Parliament of Westerås (1527). Gustavus gradually accustomed his subjects to the rule of law and order by regulating taxation, introducing administrative and economical reforms, but, above all, by endearing them to his person. Agriculture, the mining industries, trade and commerce greatly developed during his reign. He also freed the land from the crushing privileges of the Hanseatic League, and laid the foundations of a navy. At the Parliament of Westerås (1544) the crown was made hereditary in his family. Gustavus Vasa was highly neurotic, and this strain of abnormal mentality appeared in most of his descendants until the very end of the Vasas (1877). See SWEDEN for picture.

BIBLIOG.—H. W. Van Loon, *Adventures and Escapes of Gustavus Vasa and How They Carried Him From Rather Obscure Origin to the Throne of Sweden* (1945).

**GUSTAVUS II ADOLPHUS**, 1594–1632, king of Sweden, son of Charles IX, was born in Stockholm and became king in 1611. His tact and wisdom gradually gained over



SWEDISH TRAFFIC ASSN.

**Gustavus Adolphus**

the wealthy nobles whom his stern father had attempted to crush, and persuaded them to take the chief burdens on their own shoulders. Yet he protected the lower classes against the tyranny of the landowner, reorganized the government, and placed it in the hands of a well-organized bureaucracy. Moreover, commerce was promoted, new towns built, and everything done to restore the national credit and prosperity. The war against the Danes, who at the time of his accession, held the whole of south-

ern Sweden, was terminated by the not inglorious peace of Knäröd (1613), while the Russian war was concluded four years later by the advantageous treaty of Stolbova (1617), whereby Sweden acquired Karelia and Ingria. The war with Poland, on the other hand, dragged on for nine years, in the course of which Gustavus won (1621–99) the provinces of Livonia, Estonia, and Courland. Peace with Poland at length left him free to turn his attention to Germany, and in response to appeals for help from the hard-pressed Protestants of the empire he landed on the isle of Usedom in the summer of 1630.

In September, 1631, Gustavus won against Tilly the decisive battle of Breitenfeld, near Leipzig (Sept. 17, 1631). He then marched through Thuringia and Franconia to the middle Rhine. After wintering in Mainz (Mayence) he united at Kitzingen with the Swedish general Horn, and started in pursuit of Tilly. On April 15 his superior artillery enabled him to force the passage of the Lech against the imperialist general, who was killed, and the whole of Bavaria lay defenseless before him. Gustavus, having failed to prevent Wallenstein's junction with Maximilian of Bavaria at the beginning of July, entrenched himself at Nuremberg, and was repulsed in a murderous attack (September) upon Wallenstein's entrenched camp. Nevertheless Wallenstein retreated, and Gustavus hastened after him by forced marches, and overtook him on the plain of Lützen, near Leipzig, where, on Nov. 16, 1632, after a severe encounter, Wallenstein was compelled to fall back upon Leipzig, with the loss of several guns. Gustavus Adolphus fell in the battle. See THIRTY YEARS' WAR for illustration.

BIBLIOG.—Sir G. F. MacMunn, *Gustavus Adolphus, the Lion of the North* (1931).

**GUSTAVUS III**, 1746–1792, king of Sweden, eldest son of Adolphus Frederick. His first step after his accession to the throne in 1771 was to overthrow the oligarchical tyranny of the nobles by the bloodless coup d'état of Aug. 19, 1772. During the following 12 years Gustavus regenerated Sweden, reforming abuses, promoting commerce and agriculture, replenishing the exchequer, encouraging the arts and letters. On the other hand, he maintained a court of extraordinary splendor, which became a burden to the people. The mutinous attitude of the Parliament of 1786, and his declaration of war against Russia in 1788 without consulting Parliament brought matters to a head. The open mutiny of his officers paralyzed his efforts in Finland, and in 1788 the Danes, under the terms of a treaty with Russia, invaded Sweden. But Gustavus saved Gothenburg, and compelled the Danes to make peace. The Russian war, which dragged on for two years longer, was ended by the almost complete annihilation of the Russian fleet at the battle of Svenskund (July, 1790). Meanwhile a section of the nobility formed a plot to assassinate Gustavus, and he was shot by Anckarström at a masquerade at the opera house.

**GUSTAVUS IV**, 1778–1837, king of Sweden, only son of Gustavus III, was born in Stockholm and became king in 1792, ruling through a regent, the Duke of Sudermania, during his minority. In 1800 he joined the armed neutrality of the northern powers, and after working (1803) for the restoration of the Bourbons, joined the coalition against Napoleon, against whom he conceived an almost childish hatred, which led him to lose Rügen and Stralsund rather than accept the favorable conditions of peace offered to him by Napoleon in 1807. Napoleon induced the Russians to invade Finland, which they did without previous declaration of war, and ultimately they conquered and annexed it (1808–9). When England advised him to make peace, Gustavus retaliated by laying an embargo on all British vessels in Swedish ports. It now became obvious that the king was afflicted with insanity, the hereditary disease of the Vasas. His own subjects deposed him (May, 1809) and he retired to Switzerland, where, a lonely and

unhappy man, he died at St. Gall. With the death of his son in 1877 the male line of the House of Vasa-Palatinate-Hesse became extinct.

**GUSTAVUS V**, 1858–1950, king of Sweden, the eldest son of King Oscar II. After having acted as regent of Sweden many times, he ascended to the throne Dec. 8, 1907, upon the death of his father. In 1881 Gustavus married Princess Victoria, daughter of the Grand Duke of Baden and the grand daughter of Emperor William I of Germany. He popularized his favorite sport, tennis, and won many matches. Gustavus maintained neutrality throughout both World War I and World War II. He established large endowments for cancer and rheumatic research in 1928 and 1938, and was responsible for much liberal legislation in Sweden. In 1939 he met with the kings of Norway and Denmark and the president of Finland at Stockholm for the unsuccessful purpose of preserving the neutrality of the Scandinavian countries.

**GUSTAVUS VI**, 1882–, king of Sweden, son of Gustavus V, was crowned Oct. 30, 1950. He married Princess Margaret of Connaught, granddaughter of Queen Victoria, in 1905. She died in 1920, and Gustav was remarried in 1923, to Lady Louise Mountbatten. Educated at Uppsala University, the king was an amateur archeologist. His son, Gustavus Adolphus, 1906–47, was killed in an airplane crash. He was survived by his wife, Princess Sibylle, Crown Prince Carl Gustavus, and four daughters.

**GUSTAVUS ADOLPHUS COLLEGE**. See COLLEGES.

**GUTENBERG, JOHANN**, c. 1397–1468, German printer who is generally credited with the invention (at least in the Western world) of printing with movable type cast in molds. Few details of his life, other than those recorded in legal documents, are known. He was born in Mainz and his father's name was Gensfleisch. Following a common enough custom of the time, he adopted the name Gutenberg which was either his mother's maiden name, or the name of property belonging to her, or of the place where she was born.

**Lawsuits, Loans, and Fust**. In his youth Gutenberg's family was compelled to leave Mainz and settled in Strasbourg. He is first heard of there as being involved in a lawsuit concerning certain inventions on which he was at work with two partners and it is quite likely that they might have had to do with printing. Then, in 1441 and the next year, he is known to have borrowed money to carry on his work. Some time before 1450 Gutenberg moved back to Mainz, for there is a record in that year of a loan he obtained from the goldsmith JOHANN FUST, this also to help him in finishing his work. Another loan was made by Fust in 1452 but as neither sum had been repaid in 1455, Fust brought suit to recover all he had advanced with interest as well as Gutenberg's equipment. Fust's son-in-law, Peter Schöffer, testified as his witness, while on Gutenberg's side

testimony was given by Bertolf von Hanau and Heinrich Keffer who are spoken of as servants. Gutenberg states expenses for wages paid, for rent, paper, parchment, and ink. Thus it would appear that the whole affair was concerned with printing. It is known that Fust and Schöffer continued printing. In 1465 the Archbishop Adolf of Mainz made Gutenberg "servant and courtier" for valuable services, whether for political reasons or for his work in furthering the development of type is not known.

**Inventor of Printing?** There has been much learned dispute as to whether or not Gutenberg was the inventor of printing. In the 17th century the honor was given to Pamfilo Castaldi, the first printer in Milan, and always there has been the claim of LOURENS JANSZON COSTER of Holland. However, most of the evidence still points to Gutenberg if sympathies are tempered for either side with the likelihood that printing, in common with all of man's greatest discoveries, was not arrived at by one individual alone.

None of Gutenberg's work is dated or signed with his name. Popular opinion still holds to the belief that the great Gutenberg Bible, published in Mainz about 1456, is his first completed work and his masterpiece, although there is much evidence that he had printed other small works before the Bible. Even his claim to the great Bible has been contested and it is believed by many that it was begun by him and completed by Fust and Schöffer. It will always hold its place as one of the world's greatest examples of printing. It is known as the "42 line Bible" because almost every column of its double-columned pages consists of 42 lines. The text was printed in Latin, and this was before the appearance of curved letters, with spaces left vacant for the initials which were added by scribes by hand. Thus the famous volume forms a bridge between the manuscript and the printed book. There is a beautiful copy in the John Pierpont Morgan Library in New York. In spite of all dispute and controversy, Gutenberg's name will always be connected with this Bible and although not even a portrait made of him in his lifetime survives, he still dominates the history of printing in Europe. Perhaps the most balanced viewpoint is that before Gutenberg, Coster in Holland printed from movable type, but that Gutenberg invented the mold from which type was cast. See BIBLE; GUTENBERG (Back End Papers, Vol. 7); PRINTING. HUGH EDWARDS

**BIBLIOG.**—L. E. Tomlinson, *Gutenberg and the Invention of Printing* (1938); M. B. Cary, *Missing Gutenberg Wood Blocks* (1940); O. W. Fuhrmann, *Gutenberg and the Strasbourg Documents of 1439* (1940); D. C. McMurtrie and D. Farran, *Wings for Words* (1940); D. C. McMurtrie, ed. and tr., *Gutenberg Documents* (1941).

**GUTHRIE, JAMES**, 1792–1869, American lawyer and legislator, was born near Bardstown, Ky. He began to practice law in 1820 at Louisville, was elected to the lower house of the State legislature in 1827 and served for 15 years; was president of the Kentucky constitutional convention (1849); secretary of the treasury in Pierce's cabinet (1853–57); and Democratic senator from Kentucky from 1865 to 1868, when he resigned because of ill health. In 1860 he was a candidate for the presidential nomination at the Democratic National Convention at Charleston, S.C., but afterward supported the national government.

**GUTHRIE, THOMAS ANSTEY**. See ANSTEY. **GUTHRIE**, city, N central Oklahoma, county seat of Logan County, on the Cimarron River, the Santa Fe and the Oklahoma railroads, and U.S. Highway 77; about 35 miles N of Oklahoma City. Guthrie is an important railroad, trade, and distribution center for the surrounding agricultural and oil-producing region. It has railroad shops and creameries and manufactures caskets, cottonseed oil products, feed, and beverages. Guthrie was established on Apr. 22, 1889, when Oklahoma was thrown open to the public.

### Gutenberg examines the first printed proof

AMERICAN INST. OF GRAPHIC ARTS





Within 24 hours, some 8,000 people were encamped upon what had been uninhabited prairie land. Guthrie was the territorial capital of Oklahoma from 1890 to 1907 and the state capital from 1907 to 1911. The Catholic College of Oklahoma is near by. Pop (1950) 10,113.

**GUTIÉRREZ, ANTONIO GARCÍA.** See GARCÍA GUTIÉRREZ.

**GUTS MUTHS, JOHANN CHRISTOPH FRIEDRICH,** 1759–1839, German educator, was born in Quedlinburg, and for more than 50 years (1785–1837) was a teacher at Schnepfenthal in the Thüringerwald. He instituted a new method of teaching geography, and is largely responsible for the system of gymnastics introduced into German schools. He is chiefly known for his handbooks on these subjects, and his *Deutsches Land und Deutsches Volk* (1820–32).

**GUTTA-PERCHA**, a substance resembling rubber, obtained from certain trees of the family *Sapotaceae*, found chiefly in the Malay Peninsula, Borneo, Sumatra, Ceylon, and the Philippine Islands. It is a leathery solid, elastic but lacking the flexibility and resiliency of rubber. It becomes plastic at about 65° C., and burns brightly when ignited. It is resistant to most acids and to alkalis, is insoluble in water but dissolves readily in chloroform. It is composed mainly of a hydrocarbon and its oxidation products. Although long known in Europe, it did not come into general use until 1842.

The best gutta-percha is obtained from *Palaquium gutta*, a large tree with a trunk several feet in diameter. On exposure to the air, the milky juice coagulates, assuming a brownish color. The method of preparation is not unlike that employed for rubber. After being cleaned, the coagulated milk is kneaded between rollers, under running water, and run out into thin sheets, so as to expel the air and permit drying. It is then put into a machine called a masticator, consisting usually of a hollow, fluted roller revolving within a hollow casing, both the roller and casing being heated by steam. This is made to revolve until the product is in condition for working.

One of the most important uses of gutta-percha is for the electrical insulation of wires, especially for submarine cables, for which it is almost universally employed. Its resistance to acids also renders it valuable in chemical works and glass works, and it is used in making jars, pipes, etc. It is largely used in dentistry and surgery and in the manufacture of golf balls.

**GUTTATION**, the loss of water from normal leaves and stems through small organs called *hydathodes*. These organs are specialized epidermal structures or small openings that are directly connected with the water-conducting system. Guttation water is usually found in small drops on the tips and edges of the leaves. It appears on warm, humid nights when the soil temperature favors root absorption but the air is sufficiently moist to reduce transpiration. It is thought to have a function in the regulation of turgor pressure in plants.

**GUTTENBERG**, town, New Jersey, in Hudson County, near the Hudson River, in the New York metropolitan section. Pop. (1950) 14,357.

**GUTZKOW, KARL FERDINAND**, 1811–78, German novelist and playwright, was born in Berlin. He first attracted attention with *Wally, die Zweiflerin* (1835), a novel denounced by many as being licentious. The resultant storm of protest brought about Gutzkow's imprisonment for three months and led to the suppression of his works. A leader of the "Young Germany" group, he injected political and social issues into his work, often with a heavy hand. He eventually won recognition, however, as a pioneer in the field of the German social novel. His principal works are *Zopf und Schwert* (1844), an historical comedy; *Uriel Acosta* (1847), a tragedy; and *Die Ritter vom Geiste* (1850–52), a novel.

**GUY OF LUSIGNAN**, d. 1194, king of Jerusalem from 1186 to 1192. For a short time in 1183 he was regent for his stepson, Baldwin V. With the support of Reginald of Châtillon he was elected king in 1186. However, he was defeated and captured next year by Saladin in the Battle of Hattin. Upon his release in 1188 he besieged Acre. With the aid of Britain and France, Acre was captured in 1191. Philip II of France opposed Guy's right to the throne of Jerusalem. In 1192, in spite of the support of Richard I of England, Guy had to resign from the throne. In return he received the island of Cyprus.

**GUY OF WARWICK**, an old metrical romance, apparently of Saxon origin, but popularized by a French or Anglo-Norman writer. It was current in French in the 13th century, became popular, and was translated into English. The hero, Guy, loves Felice, the daughter of his lord, the earl of Warwick. To prove himself worthy of her, he makes two journeys to the continent, where he has many thrilling adventures. Returning to England, he slays a dragon, marries Felice, and sets forth for the Holy Land. Returning once more, he slays the Danish champion Colbrand and retires to a hermit's cell, where he dies.

**GUYENNE.** See GUIENNE.

**GUZMÁN, CIUDAD.** See CIUDAD GUZMÁN.

**GUZMÁN, GASPÁR DE.** See OLIVARES.

**GUZMÁN-BLANCO, ANTONIO**, 1829–99, president of Venezuela, was born in Caracas. He fought as a Federalist under General Falcon, and was elected president of the Assembly which transformed Venezuela into a confederation on a democratic basis. Between 1870 and 1889 he was generally titular president, and always virtual dictator, of Venezuela, and during that period re-established public credit, promoted education, and opened the first railway in the country.

**GWALIOR**, formerly one of the five leading feudatory states of India, now merged with others in the Madhyabharat Union; area 26,397 sq. mi.; pop. (1941) 4,006,159. Gwalior lies S of the United Provinces, from which it is separated by the Jumna River, and E of Rajputana, from which it is separated by the Chambal and the Parbati rivers, the latter joining the Chambal at the north of Gwalior's western bulge. Gwalior, in its southern part, has a number of detached and semidetached districts intricately interspersed by portions of other states. The people are largely Hindu, but a sizable proportion of the population is Mohammedan.

North Gwalior is a plain extending 80 miles south of the Chambal, with a width of 120 miles at the widest portion, broken in the southern part by low hills. This plain is only a few hundred feet above sea level, has a hot climate, a good rainfall, and the densest population of the state. South of the plain lies the most fertile area, a gradual ascent to the central Indian plateau, which at Sifri reaches a height of 1,500 feet; the climate is cooler than that of the plain country. A third region is the district of Amjhara, among the Vindhya Mountains. Gwalior has many rivers, most of them discharging into the Chambal.

Aided by more than 850 irrigation installations, Gwalior raises wheat, millet, pulse, corn, rice, linseed and other oil seeds, sugar cane, cotton, tobacco, indigo, garlic, turmeric, and ginger. The chief industries are cotton processing and weaving, leather, and pottery.

The state has some 2,200 educational institutions, including Victoria and Kamla Raja Girls Intermediate College at Gwalior and the Madhav College at Ujjain; in addition there are technical and medical schools and secondary schools.

The state has 2,384 miles of paved highway; the extensive railway mileage is state-owned and controlled, and there is a seaplane base at Madhav, a station on the empire air routes.

**Government and History.** Politically, Gwalior was one of the more advanced of Indian states, having a legislature of two houses; 55 of the 90 members of the lower house were elected. Both houses had identical powers. The government afforded special protection for the minority Moslems, the so-called backward classes, and women; all three groups were guaranteed a minimum number of seats in the lower house, and the Moslems and women were guaranteed a minimum number of seats in the upper house. The ruler was assisted by a council of ministers under his direct control. The Gwalior army was the best of the Indian states' troops and had infantry, cavalry, and artillery elements. The capital of the state was Lashkar (sometimes called New Gwalior), immediately to the south of the city of GWALIOR, a highway and railway junction in the north central part of the state.

The ruling family (Sindhia) belongs to the Mahratta nation. The first of the house was Ranoji, who in the 18th century was authorized to collect tribute in the Malwa districts. He established his headquarters at Ujjain, the first capital of Sindhia dominance. The real founder of Gwalior was Mahadji, a natural son of Ranoji, who was granted his father's possessions in 1769. In 1782, after a war with the British, Mahadji agreed to withdraw to Ujjain, and the British to retire north of the Jumna, Mahadji accepting a British resident at his court. Thereafter, the British remaining inactive, Mahadji rapidly established his authority over Hindustan proper. In 1785, he re-established Shah Alam on the imperial throne at Delhi and in 1788 set himself up as a protector of the aged emperor. The Mahratta confederacy resented the placing of the state under British protection by Daulat Rao, an adopted son and the successor of Mahadji, and fought the Mahratta war of 1803. Gwalior lost the territory between the Jumna and the Ganges, the district of Broach in Gujarat, and some land in the south; in 1818 Daulat Rao ceded Ajmere; and, following a British invasion, in 1843 he ceded more territory to the British. During the Indian Mutiny of 1857, the ruling maharaja remained loyal to the British, but his troops joined the mutiny. The ruler fled his capital, which was subsequently retaken and restored to him in 1858 by the British, who gave him as a reward for his loyalty the districts of Neemuch and Amjhera. On May 15, 1948, Gwalior merged with Indore and 20 smaller Malwa states to form the Madhyabharat Union, one of the largest of the unions of Indian states. The Maharaja of Gwalior became the president of the new union for life. C. S.

**GWALIOR**, city, India, capital of the former state of Gwalior; 65 miles S of Agra. The old city, in the north, contains a huge fortress, from which an

extensive view is obtained; the Man Singh Palace; and the Teleka-mandir, a Hindu temple. In the new city, known as Lashkar, are the Maharaja's palace, the government buildings, post office, hospital, and hotels. Pop. (1941) 182, 492.

**GWATHMEY, JAMES TAYLOE**, 1865-1944, American physician, was born in Norfolk, Va., and graduated from Vanderbilt University Medical School. A leading American authority on anesthesia, he described the ether-oil method of rectal anesthesia (1913); with Howard T. Karsner, introduced the method of administering ether and oil through the mouth for painful dressings; with Asa B. Davis, introduced obstetrical anesthesia in New York City (1923). He wrote *Anesthesia* (1914), one of the most comprehensive and authoritative works in this field. His research on anesthetic techniques contributed largely to present-day uses in operative surgery.

**GWINNETT, BUTTON**, c. 1735-77, American patriot, was born in England. In 1770 he settled in Charleston, S.C., and afterward he was a planter on St. Catherine's Island, Ga. He was an active revolutionist, a delegate from Georgia to the Continental Congress, and one of the signers of the Declaration of Independence. In 1777 he was defeated for the governorship of Georgia and also for the post of brigadier general of the Georgia troops. He was mortally wounded in a duel with Gen. Lachlan McIntosh, the successful candidate for the latter office. His autographs, because of their rarity, are valued at high prices.

**GWYNN, GWIN**, or **GWYN, NELL**, 1650-87, English actress, born probably in Hereford. She grew up in poverty and, as a child, sold oranges and sang at various taverns to earn her bread. She first appeared on the stage in 1665, in Dryden's *Indian Emperor*, and her piquant and sprightly manner gained her great popularity. Among her many lovers were Charles Hart, the Earl of Dorset, Lord Buckhurst, and after 1669 Charles II, to whom she bore two sons—Charles Beauclerk (1670), afterward duke of St. Albans, and James (1671), who died in his youth. She was faithful to her royal lover and became a general favorite with the people for her good humor and unflinching charity. Several plays have been based upon her career.

**GYA**. See **GAYA**.

**GYAROS**. See **CYCLADES ISLANDS**.

**GYGES**, king of Lydia, founder of the dynasty of the Mermnadæ; reigned about 687-657 B.C. Herodotus relates that King Candaules, whose favorite he was, being extremely proud of the queen's beauty, hid Gyges in the royal bedchamber that he might see her unveiled charms. The queen discovered him and sending for him the following day bade him choose between the murder of Candaules and marriage with her, or his own death. He accordingly killed the king and seized the kingdom. Subsequently he fought against the invading Cimmerians, and sent soldiers to Egypt to help that country free itself from Assyrian rule; but the Cimmerians returned, killed Gyges, and devastated his kingdom. Gyges is the subject of a myth which imputes to him the possession of a magic ring which had the power of rendering its wearer invisible.

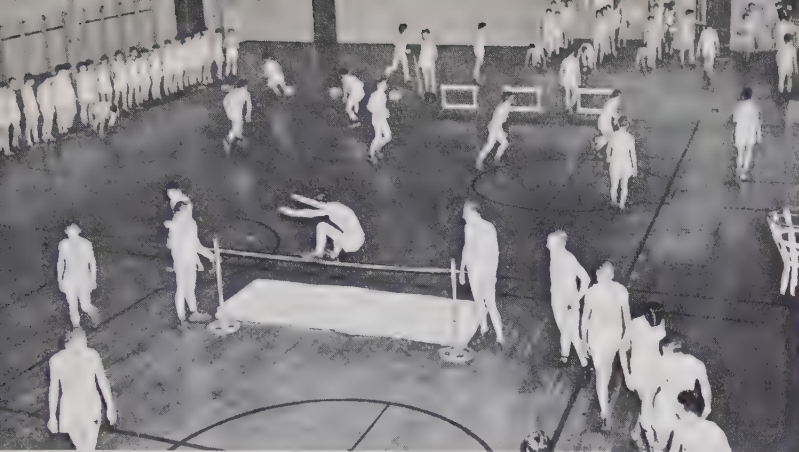
**GYMNASIUM**, a special room or building devoted to the promotion of physical education and improvement. It is by no means a modern innovation, as gymnasia were an important adjunct of Greek education. The first gymnasium connected with an educational institution in the United States was that of the Round Hill School in Northampton, Mass., built in 1825. Today no modern educational institution is complete without a well-equipped gymnasium. A typical gymnasium includes one large hall with suspended running track, smaller rooms for boxing, fencing, wrestling, handball, rowing machines, etc., offices and examination rooms, locker rooms, bath-rooms, and swimming pool.

The great fortress at Gwalior, India

GOVT. OF INDIA INFORMATION SERV.







CHICAGO BOARD OF EDUCATION

### Gymnasium offers facilities for healthful physical exercise

The term *gymnasium* is also applied to the classical secondary schools of Germany which precede the university course, and which are distinguished by the study of classical languages. The *realgymnasien* correspond to the *gymnasien* in grade but lay greater emphasis on mathematics, modern languages, and the sciences. They drop Greek but retain Latin. Both the *gymnasium* and the *realgymnasium* offer a nine-year course.

**GYMNASTICS**, a system of physical exercises undertaken for the development of health, strength, and vigor, generally distinguished from **ATHLETICS** or field sports. The practice of organized gymnastics, as a phase of education, was originated in ancient Greece. Physical training formed one of the chief items in the education of the Greek youth, and in the great religious festivals of Greece the public games played a commanding and essential part, each state training and sending forward its competitors. See **OLYMPIC GAMES**.

Plato, writing on education (see various parts of *Leges*), devoted much consideration to the necessity of gymnastic training for the young; and about this time, Prodicus, who seems to have been the first to notice the intimate connection between the practice of gymnastics and health, designed a system of exercises, which were afterward improved by Hippocrates (400 B.C.). The principal exercises were running, leaping, wrestling, swimming, and the "pancraton," a combination of boxing and throwing of various missiles, such as the javelin and the discus. At a somewhat later period the javelin-throwing was discontinued, and a new sport, called the "pancraton," a combination of boxing and wrestling was substituted.

The ancient German race (50 B.C.), was likewise noted for its love of manly exercise—leaping, running, wrestling, putting the stone, etc., which are mentioned in the *Nibelungenlied*; and there, as also somewhat later in Britain, the cultivation of strength, the performance of manly deeds, and the various acts of knightly prowess were continued down to the end of the Middle Ages. From this time onward the attention paid to athletic exercises decreased in Britain and Europe generally, and during the 17th century, and, indeed, until the end of the 18th century, fencing was the only exercise worthy of the name.

In 1762 Rousseau (in *Emile*) succeeded in arousing some interest in the subject of gymnastics; but its real revival occurred in Germany, about 1811, when F. Ludwig Jahn, called affectionately by his pupils "Father Jahn," established numerous *Turnplätze*, or gymnasia, at Berlin, which became extremely popular among the youth of the country. In 1813 Sweden followed the Prussian example, and established gymnasia under LING, and since that time physical training has formed a prominent item in the Swedish educational curriculum. Public attention was again attracted to the subject in France in 1845, but not

until 1869 were any practical steps taken to make gymnastics a real part of education. Belgium and Italy also adopted more or less systematic methods of gymnastic training in their schools and armies about this time.

In England, until 1858, gymnastics proper received but scant attention, boxing being the chief exercise of the upper classes in the first half of the 19th century. The advantages of gymnastic training were, however, appreciated by the British military authorities, and a beginning was made in about 1860, toward developing the system

which is now an important feature of the soldier's training. Exercises and methods are put on a systematic basis, and the gymnastic training of the recruit in well-equipped gymnasiums is carried on with his military education.

In the United States military gymnastics are also an essential part of the training of the Regular Army and National Guard, and a plan of exercise is followed, aimed both to develop the new recruit and to keep the soldier in the best possible physical condition.

Gymnastics also occupy an important place in the scheme of instruction in practically all American colleges, where exercise along prescribed lines is required on the part of the students. The same is true of many secondary schools, much attention being paid to the physical training of the young by systematic gymnastic exercises, under competent instructors and advisers.

**Gymnastic Exercises** may be broadly divided into three groups: (1) free movements of the body without fixed apparatus, which are, generally speaking, adaptations of the Swedish system of Ling, and which include exercises with dumbbells, bar bells, and Indian clubs, as well as movements without weights or hand apparatus; (2) pure gymnastics, with the use of heavy apparatus, such as the horizontal bar, the parallel bars, the traveling rings, the vaulting horse, the trapeze, the climbing rope, and jumping apparatus; (3) antagonistics—boxing, fencing, single stick, quarterstaff, and sometimes wrestling. Weight lifting, too, is sometimes introduced into gymnastic competitions.

B. C.

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**GYMNEMA**, a genus of evergreen tropical climbing shrubs belonging to the milkweed family. *G. lactiferum* is valued by the Sinhalese of Ceylon for its milky juice, which the natives use as a food. The gymnemas can be grown in a warm house in a peaty soil.

**GYMNOSPERMS**, a group of trees and shrubs with mostly narrow, evergreen leaves, monoecious or dioecious flowers, and exposed seeds in a strobilus or cone. Gymnosperms comprise a subdivision of the phylum Spermatophyta. They include many such economically important plants as pines, spruces, and firs, which yield valuable lumbers, resins, turpentine, and medicinal supplies. See **BOTANY**; **SPERMATOPHYTES**.

**GYMPIE**, gold field and town, Australia, Queensland, on the Mary River; 107 miles by rail N of Brisbane. Gold was first found here in 1867. Pop. (1947) 8,413.

**GYNANDROMORPH**, **GYNANDER**, or **SEX MOSAIC**, is an animal in which part of the body is female and part is male. This condition occurs occasionally in lower animals and is due to a genetic abnor-

malinity. Some gynanders have right and left halves of different sexes. Instances have been reported, however, in which the dorsal and ventral halves of some individuals and the anterior and posterior halves of others differed sexually. In other gynandromorphs the body may be predominantly of one sex with only a limited portion of the opposite sex. The most striking cases of gynandromorphism are found in those animals that show conspicuous differences in form, coloration, and behavior between the two sexes and in those in which one part of the body can develop more or less independently of the rest with respect to sexual differences. Thus gynandromorphism is conspicuous in insects in which there is an absence of hormones as contrasted, for example, with man and other mammals, in which sex hormones are present. These sex hormones circulate widely in the blood stream and stimulate uniformly throughout the whole organism the development of sexual characteristics. See SEX.

Gynandromorphism has been shown to arise in several ways. One method, demonstrated in the fruit fly, *Drosophila*, is by an abnormality in division of the female-determining egg cell. This cell possesses two X chromosomes (as opposed to the single X chromosome found in the male-determining egg cell). If, during the division into the first two cells of the future body, one cell fails to receive two X chromosomes, a gynandromorph results. One of the two cells of this division gives rise to all the cells of one side of the body, while the other cell gives rise to the cells of the other side.

Gynandromorphism in honeybees and in silkworms may result from fertilization of a binucleated (having two nuclei) egg, with one of the nuclei becoming female-determining, the other male-determining. In the honeybee an unfertilized egg becomes a male and a fertilized egg becomes a female; thus a gynander is believed to result sometimes from the fertilization of a binucleated egg by a single sperm cell, in which only one nucleus combines with the sperm nucleus.

It has been observed in a gynandromorph of the wasp, *Habrobracon*, in which the anterior and posterior parts of the animal are of different sexes, that nervous system centers of the anterior region determine the mating behavior of the whole organism, e.g., if the head is male, mating behavior is male. Similarly, it has been found that *Drosophila* with bilateral gynandromorphism may show certain bilateral differences in behavior characteristic of the two sexes.

The term gynandromorph should not be confused with HERMAPHRODITE, which is an individual having both ovaries and testes.

FRANK A. BROWN, JR.

**GYNECOLOGY** is that branch of medicine that is concerned with what are sometimes referred to as "women's diseases." Specifically, it includes medical and surgical care of disorders of the reproductive system (ovaries, fallopian tubes, uterus, and vagina), the external genitalia (the vulva and clitoris), the urinary system and the rectum in women. Usually diseases of the breast also are included in this specialty. Originally simply an offshoot from general surgery, this specialty has become more sharply defined in recent years, and with development of new treatment fields within its more or less arbitrary limits now includes a significant array of therapeutic measures. Perhaps most significant among these have been the widespread use of hormonal remedies, and treatments, both medical and surgical, for correction of sterility. Many specialists in gynecology combine with it the practice of OBSTETRICS.

**GYNERIUM**, a genus of American tropical and subtropical grasses, with dioecious flowers, of which pampas grass *G. argenteum*, is the best known.

**GYÖNGYÖS**, town, Hungary, situated at the foot of the Mátras Mountains and on the Gyöngyös River, 64 miles by rail NE of Budapest. An old town, Gyöngyös has a 15th-century Franciscan monastery. It is noted for its excellent wines and for its textiles.

There is trade in grain and livestock. Pop. (1948 est.) 24,100.

**GYÖR**, German **Raab**, town, NW Hungary, capital of the county of Győr, situated at the confluence of the Rába (Raab) and Leitha rivers; 75 miles by rail NW of Budapest. Győr is a well laid out town, and is the most important industrial and commercial center in western Hungary. Features of interest include a 13th-century cathedral, a bishop's palace (15th century), the Town Hall, and near by is the famous Benedictine abbey, St. Martinsberg. Agricultural machinery, chemicals, leather, boats, and vehicles are manufactured; there is good trade in grain, and Győr is the center of a famous horse market. The town is located on the site of the ancient Roman city of Arabona. In the 11th century it became a county seat, and in the ensuing years because of its strategic location Győr was the scene of recurrent struggle. In World War II it was captured by the Soviet army on March 28, 1945; its capture cracked the Nazi Danube Valley defenses protecting the Bratislava Gap, the gateway to Vienna. Pop. (1948 est.) 48,800.

**GYP**, pseudonym of **Marie Antoinette de Riquetti de Mirabeau, Countess de Martel de Janville**, 1850-1932, French novelist. She had a talent for breezy dialogue and characterization, and her novels of Parisian "high life" and political intrigue were widely read during the 1880's and 1890's. She was actively interested in the politics of this period, and a number of her novels were devoted to anti-Semitic and nationalist propaganda. Among her most popular works were *Little Bob* (1882); *Chiffon's Marriage* (1894); *Bijou* (1896).

**GYPSOPHILA**, a genus of annual and perennial plants belonging to the Pink family, *Caryophyllaceae*. One species, *G. muralis*, naturalized from Europe, is found along roadsides and in fields throughout the United States. It is distinguished by linear leaves and purple flowers. Various cultivated species, commonly called baby's-breath, have reddish or white flowers and fragile branched stems. These plants are grown extensively in rock gardens.

**GYPSUM**, a common mineral composed of hydrous calcium sulfate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ); specific gravity, 2.3 to 2.4; hardness, 2. Pure gypsum is colorless to white, but usually occurs in various shades of gray, brown, red, or pink, due to impurities. Gypsum crystallizes in the monoclinic system in tabular crystals, the planes of which are parallel to the principal plane surface. Naturally occurring pure crystalline gypsum, termed *selenite*, is characterized by an easy cleavage, yielding thin, usually flexible, transparent plates.

The most important commercial deposits are *rock gypsum*, which is opaque, granular, and massive, usually associated with anhydrite ( $\text{CaSO}_4$ ), which has the same geologic origin. Other forms of gypsum are *alabaster*, a fine-grained, white, translucent rock suitable for sculpturing; *satin spar*, a fibrous variety consisting of long, silky crystals with a satiny or pearly luster; and *gypsite*, an earthy gypsum made up of small gypsum crystals scattered through clay or loam.

**Plaster of Paris**. Gypsum owes most of its commercial value to the fact that it loses three-fourths of its water of crystallization when calcined (heated) between 235° and 260° F. to form **PLASTER OF PARIS** ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ), commonly called "stucco" in the gypsum industry. When mixed with a definite quantity of water, plaster of Paris combines with it and "sets," the time being controllable by addition of accelerating or retardive materials. Plaster of Paris is the base product used in compounding most building plasters and a great variety of industrial plasters.

**Other Uses**. Fabricated gypsum products in the building industry include wallboards, plaster lath, partition tile, roof tile, and floor voids. These products are particularly valuable fireproofing materials, due to a specific property of gypsum—its ability to release



20.9 per cent of its own weight of water when subjected to heat. During a fire, gypsum plaster, board or block, is bathed in steam that issues continually from the exposed surfaces until the water of crystallization is exhausted. By protecting wood or steel structural members with gypsum surfacing materials, fire risk is decreased. Small quantities of gypsum are calcined at about 450° F. to form soluble anhydrite ( $\text{CaSO}_4$ ) for use as a desiccant (drying agent). Larger quantities are calcined at temperatures exceeding 1000° F. to form insoluble anhydrite ( $\text{CaSO}_4$ ), which is used in the manufacture of Keene's cement and for fillers. Raw gypsum is used universally as a retarder in portland CEMENT. It is also used as land plaster, in fertilizers, for ornamental stone, and as a flux in smelting nickel ore and in the treatment of certain lead-copper concentrates. Gypsum is used in the manufacture of sulfuric acid, sulfate salts, sulfur, and hydraulic cement in Germany, France, the



U.S. GYPSUM CO.-HEDRICH BLESSING

**Die Patterns** are prepared in gypsum, top. Below, an ornamental molding is cast in gypsum

United Kingdom, and the U.S.S.R. Substantial quantities of gypsum are produced as a by-product in PHOSPHORIC ACID manufacture in the United States, but because of the cost of purification it cannot compete with the abundant gypsum rock as a raw material in the manufacture of gypsum products.

**Sources.** The mining and quarrying of gypsum are carried on in nearly all of the important countries, but the largest producers are the United States, France, United Kingdom, Germany, Canada, and the U.S.S.R. In the United States, New York, Michigan, Iowa, Texas, California, and Oklahoma are the leading producers. H. N. HUNTZICKER

**GYPSY.** People known as gypsies form one of the most widespread and least understood groups in the world. Although they probably number less than one and a half million they are well known in Europe, North Africa, western Asia, and America. Indeed, small groups of them have gone even to Australia and New Zealand. In general they are grouped in landless nomadic bands, the members of which are traders, metal workers, fortune tellers, and minstrels. They are a wandering, carefree people in a hard-working world. Like all people who are different in looks, language, and customs they are regarded with suspicion and fear and are frequently persecuted.

While there is among them great variation in physical type, due to the incorporation of vagrant elements from many lands, they can be described, in general, as small in stature and ranging in skin color from light to swarthy dark brown. Facial features are of the CAUCASOID type, much like that of the lower caste peoples of north India. Everywhere they are distinguished by the brightly colored dress of their women and by their love of display.

Many attempts have been made to trace their origin. The name Gypsy probably derives from the widespread belief that they came from Egypt. Their own most common designation for their folk was Rom or Romany, and owing to this they sometimes were considered Rumanians. Another term often used in Europe to designate them is Atsigan, the origin and meaning of which is not known.

Evidence regarding their origin and movements lies primarily in the field of linguistics, and the unraveling of the mystery reads like a detective story. Scholars who have devoted years to the study agree that the gypsy dialects go back to an original Indian language, probably Hindustani or Prakrit with many Sanskrit elements. On the basis of a comparative study of the vocabularies and grammar of various gypsy groups it appears that there were two major movements of them out of India toward Europe.

Both were in contact with Persia and Armenia, but one apparently pushed west and north through the Byzantine Empire, while the other moved through Syria to Egypt and then across North Africa. This is indicated by the fact that while both possess Persian, Armenian, Greek, and Rumanian words of modern type, only the southern group shows pronounced Arabic influence.

The migration of the southern branch by way of Syria and Egypt may help to account for the name gypsies and the belief of many that the people bearing that name were of Egyptian origin. However, a better explanation is found in the fact that to medieval Europe the whole area of Syria, Greece, Cyprus and nearby lands was known as "Little Egypt."

While it is probable that this entry into Europe started earlier, it was in the 14th and early 15th centuries that the gypsies became well known. Historic documents contain many references to the "Count of Egypt" and his people, and to "the pilgrims from Little Egypt" who carried letters from the pope or from various sovereigns recommending that as religious pilgrims they be protected and treated generously by all peoples. This is quite understandable in terms of the period when pilgrimages to the Holy Land or to religious shrines were in vogue. One account states that the bearers of such a letter were driven from their country for being Christians—a possible reference to the pressure of the Turks on peoples of the Near East; another tells of the alms given these people. At first they appear to be held in some esteem; then come references to aid but with the stipulation that they remain not more than three days. By the end of the 15th century the privileges turned to restrictions and finally to persecution and in places to banishment. In Hungary and Rumania they were forbidden to lead a nomadic life and were attached to the soil as serfs. Banishment from Spain was decreed in 1499, from the Empire in 1500, and from France in 1504. Such edicts were often evaded but exposed the gypsies to persecutions.

There is no doubt that among the drifting bands there were many rogues and that undesirables were harbored and protected, but in general the gypsies suffered the fate of all groups which are alien or misunderstood. The fact that they spoke a strange language, wore distinctive clothing, and particularly that they claimed occult powers led to many charges. If property was lost they were the thieves; if a person disappeared they were the abductors; they were charged with breaking all moral laws and even with cannibalism.

**Gypsies in their camp at Epsom Downs, England**

ACME



Long residence in different lands has led to strong dialect differences as well as superficial changes in some customs and beliefs. Everywhere they have adopted the dominant religion of the area, whether it be Greek Orthodox, Roman Catholic, Protestant, or Mohammedan, but many of their practices and their lore retain ancient survivals. While professing to be citizens of various lands they retain a certain unity of their own. As late as 1934 a thousand Gypsy delegates from all over Europe met in Lodz, Poland, and elected one Michael Kurik as the gypsy king. During the Nazi occupation of most of Europe, the number of gypsies was greatly reduced as a result of Nazi extermination. In the United States until recently gypsies traveled widely, stopping only for a few days in one place. The men traded horses, acted as peddlers or tinkers, but seldom did any hard labor. The women went from house to house telling fortunes by means of cards or by palm reading. With the advent of the automobile larger and more permanent camps have been established in the outskirts of large cities, while considerable groups have congregated in slum districts. They still retain their love for gaudy clothes and showy ornaments and remain a people apart. The few who do settle on the land are soon lost to the group. Traces of earlier days are still seen in such practices as cross-cousin marriage, the Levirate, sororate, and payment of a price for a bride.

How a people with so little organization has managed to survive through the ages is an ethnological puzzle. They have received attention far out of proportion to their numbers, yet they have contributed little to progress and have produced few men or women of note. Even in the field of music in which they are famed they have been only fiddlers and singers of ballads and folk songs rather than creators. See PEOPLES OF THE WORLD.

FAY-COOPER COLE

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**GYPSY MOTH**, a small brown moth occurring in considerable numbers in central and southern Europe and temperate Asia, and since 1870 in the New England states. Here it has become such a menace to forest, fruit, and shade trees that extensive and costly public measures have been adopted for its extermination.

The eggs of the moth are laid, usually on the trunks and branches of trees in July and August, in oval masses, each containing about 500 eggs. These hatch the following May, and the young caterpillars soon begin to feed upon trees and shrubs of all kinds, doing much harm, and even defoliating coniferous trees. The caterpillars reach their full size (two or three inches in length) in July, when they spin themselves flimsy cocoons, from which they emerge in about two weeks as moths.

The gypsy moth, *Porthetria* or *Lymantria dispar*, was introduced into America by Professor Trouvelot, who in 1869 imported a number of living egg clusters for research purposes. Some of his specimens escaped from his study in Medford, Mass., and by 1889 had spread through the community to such an extent as to become a serious pest. The state of Massachusetts has spent well over \$3,000,000 in its efforts to exterminate the moth; individuals and municipalities have spent almost as much, and Federal aid has also been enlisted. The moth has spread to the other New England states and colonies have been discovered in New York. However, intensive airplane spraying with DDT has exterminated the pest in the Cape Cod region and several other areas.

**GYRFALCON**, a common name given to a group of hawklike birds belonging to the family *Falconidae*. These birds are distinguished by narrow



CHICAGO NAT. HIST. MUS.

### Gyrfalcon

pointed wings, a rather long pointed tail that does not spread fanwise as do the tails of most hawks, and gray or blackish-brown plumage. The legs are feathered almost down to the feet and the talons are very sharp, curved, and long. Gyrfalcons are hardy birds, inhabiting the extreme northern regions of the globe and living among rocks, bare tundra, snow, and

ice. They feed upon meadow mice, shrews, lemmings, hares, rabbits, grouse, ptarmigans, murrelets, gulls, and terns. Their nests, constructed of sticks, lichens, moss, and debris, are usually placed on ledges on the faces of steep, high cliffs along the seacoast or among the mountains farther inland. The birds fly with great rapidity, often pursuing and overtaking swift-flying sea birds.

Only three species are found in North America: the Asiatic gyrfalcon, *Falco rusticolus uralensis*, an inhabitant of Siberia, but sometimes seen on the Bering coast of Alaska, and straggling as far south as the state of Washington; the black gyrfalcon, *F. r. obsoletus*, found in Labrador and sometimes passing south into New England and northern parts of the Midwest; and the white gyrfalcon, *F. islandus*, native of Greenland and eastern arctic America, sometimes wandering as far south as the Midwest and northern Maine. The white gyrfalcon is the handsome and swiftest of all, and while the plumage may vary from a medium to light gray, the bird also occurs in a pure white form.

L. A. HAUSMAN  
BIBLIOG.—F. H. Knowlton, *Birds of the World* (1909); L. A. Hausman, *Illustrated Encyclopedia of American Birds* (1944).

**GYROSCOPE**, a revolving wheel, universally mounted. Only one point—its center of gravity—is in a fixed position, the wheel being free to turn in any direction around this point. A gyroscope of a type in general use for demonstrating is shown in Fig. 1. It has three angular degrees of freedom: the wheel is free to spin in its supporting gimbal ring about axis A; the gimbal ring is free to revolve in an outer ring about axis B which is always at right angles to the axis of rotation of the wheel; the outer ring, likewise, is free to revolve in a supporting frame about axis C which is always at right angles to the axis of the inner ring.

**History.** The word gyroscope was combined by the French from the Greek words *gyros*, meaning turn or revolution and *skopein*, meaning to view, the literal translation of the two words being "to view the revolution" of the earth. In English, the word is pronounced with the g soft as in gem. Early experiments are credited to Bohnenburger, who in 1810 constructed a gyroscope consisting of a heavy spheroid supported in concentric rings. In 1836, in a paper read before the Royal Scottish Society of Arts, Edward Lang of Edinburgh suggested an experiment with a gyroscope by which the rotation of the earth on its axis could be proved. About 16 years later, this suggestion was actually carried out by the noted French physicist, Jean B. L. Foucault, who had been experimenting with a gyroscope of his own which, as he stated, he produced "after eight months of assiduous superintendence." In 1878 the American author, G. M. Hopkins, applied an electric motor to a gyroscope like that of Foucault and was thus able to obtain much more definite and persistent results. Hopkins also made many variations in the form and structure of the original device.





Gyrocompass in use on a merchant ship

SPERRY GYROSCOPE CO., INC.

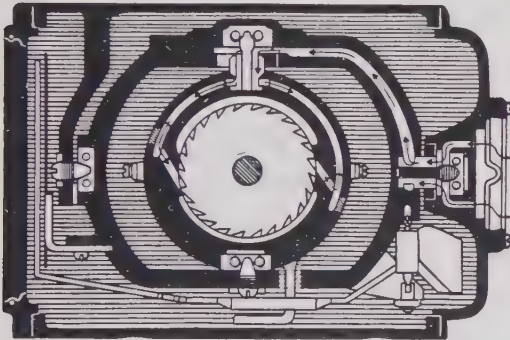
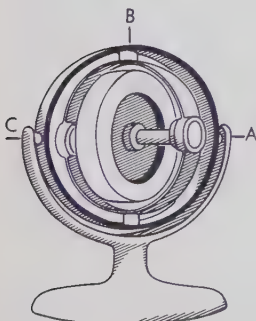
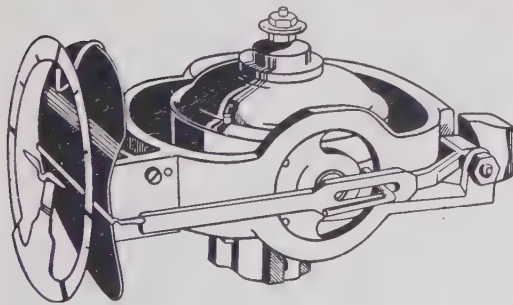
Sectional view of gyroscope, above  
View of gyroscope without case, below

Fig. 1

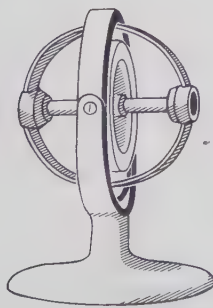


Fig. 2

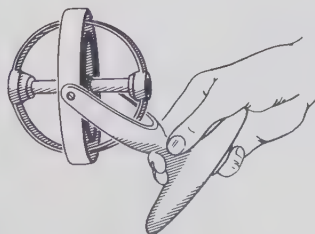


Fig. 3

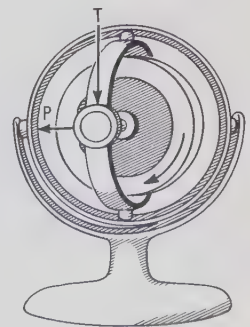


Fig. 4

It remained for Elmer A. Sperry (1860-1930), a pioneer in the electrical field, to apply the gyroscope to its first useful purpose. Sperry had become interested in a gyroscopic top, manufactured in considerable quantity about 1910 and sold as a children's toy. He studied Foucault's writings, and became convinced that the gyroscope had great commercial possibilities. From the simple elementary gyroscope with its three degrees of freedom Sperry developed the complex gyrocompass, which immediately filled the need of the navy for a compass unaffected by the magnetism inherent in steel ships. Ever since, the gyrocompass has served as the basic reference for navigation and gun control.

He founded the Sperry Gyroscope Company in Brooklyn, New York, and commenced the manufacture of gyrocompasses and other gyroscopic instruments. The outbreak of World War I followed almost immediately, and gyrocompass equipments were furnished the United States and the Allied navies as fast as they could be constructed. After the war they were installed in merchant vessels also in ever-increasing quantity. By World War II nearly 200 of the world's merchant fleets employed the Sperry gyrocompass. Development of the gyroscope for other uses kept pace with this work, the most important applications being the turn indicator, directional gyro, gyro-horizon, and the automatic pilot for aircraft.

#### CHARACTERISTICS

All of the practical applications of the gyroscope are based upon the two fundamental characteristics, namely "gyroscopic inertia" and "precession." "Gyroscopic inertia" or "rigidity in space" is the tendency of a rotating body to preserve its plane of rotation. For example, if the gyroscope shown in Fig. 2, is tilted, as shown in Fig. 3, the rotor, instead of tipping over, as it would if not revolving, maintains its original plane of rotation; and it will continue to do so, no matter how much the base of the gyro is moved about, as long as it continues to spin with sufficient velocity to overcome the friction between itself and its supporting bearings.

When a gyroscope is subjected to a couple or force about an axis at right angles to its axis of rotation, it resists that force and the degree of resistance is proportional to the velocity with which the gyro turns or "precesses" about a third axis which is called the axis of precession. For example, if a force be applied as at T in Fig. 4, it will be found that the force meets with great resistance and that the gyro, instead of moving in the direction T about its horizontal axis, turns or precesses about its vertical axis in the direction of the arrow P. If there were a complete absence of inertia and friction about the precessional axis, the rate of precession would be such that the resistance of the gyro would be exactly equal to the applied force at any instant and no movement from this force could ensue until the gyro had precessed so that its plane of rotation coincided with the plane of the applied force. Then precession would cease, and with

it, all resistance to the applied pressure. The velocity of precession is proportional to the applied torque tending to produce precession and is inversely proportional to the mass of the wheel, the radius of gyration and the speed of rotation. This may be represented in the following equation:

$$\omega = \frac{T}{I\Omega} \text{ where}$$

$\omega$  equals velocity of precession

$T$  equals torque turning movement

$I$  equals  $MK^2$  equals moment of inertia

$\Omega$  equals angular velocity of rotation

#### APPLICATIONS

The practical value of the gyroscope lies in its ability to provide a base line which is unaffected by acceleration, gravity, or other disturbing forces. Such base line may be used as a reference for control about one or more axes as it is in the case of the ship and the airplane, or it may be used as a "fix" or directional reference as it is in navigation and gunnery. In some cases the freedom of the gyroscope is suppressed about one or more of its axes in order to obtain the desired results; in others it is permitted to rotate freely about its three axes of angular motion. Brief descriptions of the gyros used in various appliances follow:

**Gyrocompass.** In the gyrocompass the characteristics of the gyroscope "inertia" and "precession" are ingeniously combined with two very constant natural phenomena—the earth's rotation and the force of gravity—with the result that the instrument aligns itself with the geographic meridian and provides a constant true north indication, irrespective of the rolling, pitching, and yawing of the vessel. All gyrocompasses operate on the same fundamental principles, but they vary considerably in the details of construction both mechanically and electrically. In the Sperry gyrocompass of the commercial type used throughout the merchant marine the gyro wheel or rotor is 10 inches in diameter, weighs 55 pounds and revolves at 6,000 rpm. The rotor has a self-contained induction motor.

A typical gyrocompass equipment consists of a master gyrocompass usually installed in a special compartment in the ship. The master compass indications are transmitted electrically to repeater compasses on the bridge and in the wheelhouse. These are used for taking bearings and for steering the vessel, respectively. The master compass also operates a course recorder which provides a continuous graphic record of the ship's headings. From this record the quality of the steering and the times and amounts of course alterations may be ascertained. Course recorder charts have proved invaluable in cases of litigation following accidents and collisions. This compass also operates the gyropilot, a device used in hundreds of vessels for automatic steering. The gyropilot contains a repeater motor operated through the master compass together with the necessary mechanism for transforming relative movement between the ship's head and the compass indication into corrective movement of the rudder. Gyrocompasses are considered one of the foremost aids to navigation, as they are entirely unaffected by disturbances which are common to magnetic compasses, and provide a fixed steering reference which does not oscillate or "follow" the yawing of the vessel.

**Turn Indicator.** In the airplane turn indicator, introduced by Sperry in 1918 and now in universal use, the gyro weighs only a few ounces and is driven by vacuum at 2 inches Hg supplied by a venturi tube or by an engine-driven vacuum pump. Turning movement of the airplane in either direction causes precession of the gyro, which through mechanical linkage, causes a pointer to indicate the rate of turn on the dial of the instrument. The turn indicator is the instrument which first made blind flying possible and is still used in all basic training in the art of in-

strument flying. It is usually mounted with a bank indicator as a single unit. See AERONAUTICS, *Aircraft Instruments*.

**The Artificial Horizon.** By means of a miniature airplane and a gyro-actuated horizon bar, the artificial horizon shows the pilot what he would see if he had good visibility outside the airplane, that is, whether the plane is banking, climbing, gliding, or flying level. The gyro weighs about a pound and is less than two inches in diameter. It is spun at 10,000 rpm by air evacuated from its case. The gyro spins about a vertical axis. A system of pendulous vanes attached to the bottom of the case causes precessional forces to act upon the gyro to keep it upright. See ARTIFICIAL HORIZON.

**The Directional Gyro** is a fixed indicator of direction for steering straight courses and for making precise turns. It is nonmagnetic and does not lag, oscillate or "run ahead." The gyro is similar in size and weight to that of the gyro-horizon, but it spins about a horizontal axis and is permitted three angular degrees of freedom. Its directional stability is due to "gyroscopic inertia." Because of bearing friction its indications are subject to drift, one way or the other, over a period of 15 or 20 minutes. There is no directive force to cause the gyro to point to a given heading like a compass. It must be reset at frequent intervals by means of a caging knob on the front of the dial. See COMPASS.

**Attitude Gyro.** This aircraft flight instrument is closely related to the gyro horizon, but it supplies the pilot with pattern indications on a stabilized sphere, and has no limit stops. The gyro sphere has universal mounting so that the instrument provides continuous indications of attitude for any angular position of the airplane. Loops, rolls, Immelmans, inverted flight, or any maneuver or combination of maneuvers can be made in clouds, at night, or under the hood, with full knowledge of the attitude of the aircraft at all times.

**Automatic Pilot.** In this instrument gyro elements keep the airplane in level flight and on its course. The relative movement between the gyros and their casings (caused by airplane movement) may be converted either by means of an air pick-off and air relay system into movements of a hydraulic servo unit, which operates the rudder, ailerons, and elevators, or by means of electric servo motors which actuate the same surfaces. The automatic pilot relieves the human pilots of the physical effort of flying and permits them to devote their attention to navigation, weather observation, and radio. Later models provide for automatic approach control with any standard instrument landing system, and fly the aircraft with even greater precision than the older types. See AERONAUTICS.

**Other Uses.** The gyroscope is utilized in both the gyro-magnetic compass and the flux-gate compass. (See COMPASS.) It also has been applied successfully in many other fields. It has been used for the steering of torpedoes for many years. All types are not controlled directionally by this device. Gyroscopes have been used to record the condition of railroad beds, such as depressions, rail spreads, etc. They are used as roll and pitch recorders for ships. The *Bore Hole Gyro* is used in oil well drilling, to trace the direction and angle of the boring; a small gyro combined with a spirit level records on motion picture film direction and angle of deflection as it is lowered down the hole. In World War II gyroscopes were applied with great success to naval gunights on anti-aircraft guns. Precession of the gyros was utilized in tracking targets in such a way that the anti-aircraft guns could be given the correct lead, regardless of the angle of fire.

P. W. BIGELOW

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**H**, the eighth letter in our alphabet, is derived from the Phoenician letter *cheth*, which was obtained from the Egyptian hieroglyphic symbol

which goes by the name of the sieve. The Semitic name, which means a "fence" or "palisade," is explained by the form of the letter **H**, which resembles a three-barred stile. The sound was that of a strongly marked continuous guttural, produced at the back of the palate, which does not exist in English, but is heard in the Scotch *loch* and the German *lachen*. When the Phoenician alphabet was transmitted to the Greeks the name *cheth* became *ēta*. As early as the seventh century B.C. this sign had two values among the Greeks: it normally represented the long *ē*, but was permissively used for the simple aspirate *h*. In the alphabet of Italy it was used exclusively for the aspirate; hence we see how the symbol **H** stands for *h* in the Latin alphabet and for *ē* in the Greek.

In German musical notation the letter **H** denotes **B** natural, the letter **B** being applied to our **B** flat.

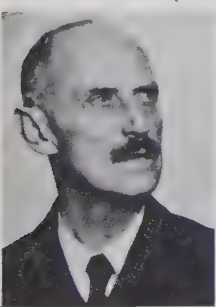
In Italian there are only three words beginning with **H**, which is silent, and used to distinguish words pronounced alike: *a* (to), *ha* (has); *anno* (year), *hanno* (they have); *o* (or), *ho* (I have). Otherwise the **H** is only used in conjunction with *c* (ch), to represent the sound of **K** before *e* and *i*.

The Russian alphabet has no **H**; in transliterating foreign names beginning with **H** the Russian **G** is used: *Harding* becomes *Garding*.

**HAAKON I**, called the Good, 915–61, king of Norway, son of Harold Fair-Hair, spent his youth at the court of King Athelstan of England. He returned to Norway (935) after his father's death, and dethroned his tyrannical brother, Eric Blood-Axe. He ruled well, kept the nobles in check, and was converted to Christianity. In 961 he was murdered by the sons of Eric.

**HAAKON IV**, called the Old, 1204–63, king of Norway, son of Haakon III, was recognized as king in 1223. A vigorous and enlightened ruler, he encouraged trade and built churches and ports. He gained (1241) the overlordship of Iceland. In his old age he undertook an expedition against Scotland in defense of the Hebrides, but was defeated at Largs (1263) by Alexander III, and died in the Orkneys on his way home.

**HAAKON VII**, 1872–1957, king of Norway, the son of Frederick VIII, king of Denmark, was known as Prince Karl (Charles) of Denmark until 1905,



NORWEGIAN OFFICIAL

**Haakon VII**

after the separation of Norway from Sweden, when the Norwegians elected him king. He was crowned in 1906. Haakon was married in 1896 to Princess Maud Alexandra (1869–1938), daughter of King Edward VII of England. Their only son, Crown Prince Olav, was born in 1903 and married Princess Märtha of Sweden, daughter of Prince Carl, second son of King Oscar II. After the Nazi invasion of Norway in April, 1940, Haakon and his government remained for two

months, refusing to acknowledge Quisling as Norway's premier, but were obliged to flee in June. Haakon set up a government in exile in London

which functioned successfully throughout the war. He returned to Oslo in June, 1945, a month after Norway's liberation. See **NORWAY**.

**HAAPAI ISLAND**. See **TONGA ISLANDS**.

**HAARDT, GEORGES MARIE**, 1886–1932, French explorer, was the first to cross the Sahara Desert by automobile and to traverse the length of Africa by the same means of locomotion. With specially constructed tractor cars he also crossed Asia into the Himalaya Mountain areas where wheeled vehicles had never passed before.

**HAARLEM**, or **Harlem**, city, Netherlands, capital of the province of North Holland, on the Spaarne River; 11 miles W of Amsterdam; 17 miles N of Leiden. The town is typically Dutch, with windmills, canals, and quaint gabled houses, surrounded by flower and vegetable gardens. In the center of the town is the Groote Markt plaza on which stand the 17th-century Meat Hall, holding the national archives; the church of St. Bavo; and the town hall. The church, a 15th-century cruciform structure, has a noteworthy organ presented by William I and still one of the world's finest and largest. The town hall, originally a 12th-century Italian Renaissance palace of the counts of Holland, contains an art gallery which features the works of Frans Hals. The Teyler Museum holds a collection of modern Dutch art and a fine geological collection. South of the town in Frederiks Park stands a pavilion housing colonial and industrial art collections. In the 17th century Haarlem was the center of a school of painting which included **FRANS HALS**, **RUISDAEL**, and many other native sons. The town was the birthplace of **LOURENZ**

#### **Amsterdam Gate in Haarlem, Netherlands**

NETHERLANDS INFORMATION BUREAU



COSTER, said by some to have been the inventor of movable printing type, and the burial-place of the poet Bilderdijk.

Haarlem is the center of world trade in flower bulbs; the surrounding countryside is entirely given over to the cultivation of tulips, narcissi, anemones, crocuses, japonicas, and hyacinths. Manufactures include the making of railway carriages, printer's type, cotton fabrics, and paint. There is trade in cheese, butter, and cattle. Printing establishments produce Dutch bank notes and postage stamps. There are also breweries and textile mills.

In 1573, after a seven months' siege, the town capitulated to the Spaniards but four years later was captured by William of Orange and permanently incorporated in the United Netherlands. A drastic change in the city's industrial life came soon afterward when the weaving of silk, lace, and damask was introduced. The city came under German rule when the Netherlands was invaded in May, 1940. It was liberated by Canadian troops in December, 1944. Pop. 158,710. K. E. H.

**HAARLEM LAKE**, a former lake in the Netherlands. It lay between the towns of Haarlem, Leiden, and Amsterdam, communicated with the Zuider Zee by the River IJ, and covered an area of about 72 square miles. In consequence of the damage done to Amsterdam and Leiden by two successive overflows of the lake in 1836, the government had it drained in 1840-53, and it now forms a commune of the province of North Holland. This undertaking was effected by digging all around the lake a large canal, into which its waters were pumped by three gigantic engines. By these means the waters were drained off to the IJ and Zuider Zee. See IJSSEL MEER.

**HABAKKUK, BOOK OF**, a short writing of the Old Testament, often called the eighth of the Minor Prophets. Nothing is known of the prophet Habakkuk (Habacuc) but from his book it appears that he lived in Jerusalem about 600 B.C. Foreseeing the imminent destruction of Jerusalem by Babylonia, he asks why God can permit the wicked to possess the earth. In a moment of revelation he concluded that "the just shall live by his faith," and thus he can survive the storm of judgment. Habakkuk then utters a series of woes against the heathen power. See BIBLE; OLD TESTAMENT.

**HABANA.** See HAVANA.

**HABBERTON, JOHN**, 1842-1921, American novelist, born in Brooklyn. He served through the Civil War; was connected with Harper and Brothers (1865-72); and served on the editorial staff of *The Christian Union* (1874-7), the *New York Herald* (1876-93), *Godey's Magazine* (1893), and *Collier's Weekly* (1899). His best-known book is *Helen's Babies* (1876), which attained an astonishing popularity both in America and in Europe.

**HABEAS CORPUS.** The writ of habeas corpus, which has been referred to as the "writ of liberty," is one of the most effectual securities against oppression which the wisdom of man has devised in that it enables a person to obtain an appearance in court to seek a speedy release from illegal imprisonment or restraint. In some countries a person who is placed in detention has no means of safeguarding his personal liberty by appearing before a court and explaining his unlawful imprisonment in order to obtain his freedom. The only object of the writ is to ascertain whether the person applying for it is legally detained.

The Supreme Court of the United States in the *Frederick* case (149 U.S. 70) stated: "While the writ of habeas corpus is one of the remedies for the enforcement of the right to personal freedom, it will not issue as a matter of course, and it should be cautiously used by the Federal courts in reference to state prisoners. Being a civil process, it cannot be converted into a remedy for the correction of mere errors of judgment or of procedure in the court

having cognizance of the criminal offense. Under the writ of habeas corpus this court can exercise no appellate jurisdiction over the proceedings of the trial court or courts of the states, nor review their conclusions of law or fact, and pronounce them erroneous. The writ of habeas corpus is not a proceeding for the correction of errors."

**Development.** Historically, the ancient writs *De odio et atia* and *De homine replegiando* were used in England before the Magna Charta of 1215, the latter by a person to seek release of his vassal and the former for somewhat the same purposes that the writ of habeas corpus is used today in some instances. The origin of the writ of habeas corpus likewise may be traced to the ancient common law, and sections 39 and 40 of the Magna Charta restated principles of freedom that included the essence of the writ of habeas corpus.

The enactment of the famous *Habeas Corpus Act* of 1679 resulted from defects in the law and was hastened by the landmark *Jenks Case* of 1676. Jenks remained in jail for many months in spite of the fact that he sought to obtain a writ of habeas corpus at different times while he was imprisoned. There was doubt in early common law whether a person could obtain a writ during the period of vacation when the courts were not open. There was no limit to the amount of bail. Only criminal matters came within the ambit of the writ and it was not returnable immediately. Today the writ is available for unlawful imprisonment in either civil or criminal cases and if an emergency is involved the statutes of Illinois, to cite one example, provide it is returnable forthwith. Penalties are now assessable against those who violate the provisions of the *habeas corpus* statute. Some of these provisions involve acts that were not within the scope of the law of habeas corpus in its early development.

The Constitution of the United States provides in Article 1, Section 9, Clause 2, "The privilege of the Writ of Habeas Corpus shall not be suspended unless when in cases of rebellion or invasion the public safety may require it." It is to be observed that the founding fathers provided that the writ is not to be suspended on the grounds of "public safety" alone.

It has been disputed as to whether the power to suspend the writ of habeas corpus belongs to the chief executive or to Congress. Although President Lincoln ordered suspension of the writ in 1861, it did not settle the question. Two schools of thought evolved and still exist on the matter. During World War II a famous case arose in Hawaii involving the power of suspension with the courts upholding the petitioner on the ground that the constitutional provision was applicable in spite of a military order to the contrary.

**Modern Application.** In order to guarantee personal freedom and enable persons to obtain the benefits that the writ contemplated it was necessary to have state constitutions and Federal and state statutes supplement the common law. Each state has its own law and the Federal government likewise is mutually exclusive of the states in that its jurisdiction is separate. There are various types of the writ of habeas corpus but the one associated with the popular mind is technically called *habeas corpus ad subjiciendum*. For examples, this is the writ that is used if a person seeks his release on the ground that his arrest is unlawful; if a prisoner seeks his freedom on the ground that his original trial and sentence were illegal; if a person is being held for trial and claims his bail is excessive; if parents seek the custody of a child or a member of the family from a hospital or asylum.

Habeas corpus means "you may have the body," and it is important to note that the writ is only the means of enabling a person who claims that he is being unlawfully deprived of his liberty to appear in court with the person who is withholding his freedom. A hearing before the judge follows and the petitioner



may or may not be granted his freedom. In most cases the latter is effected.

In *People ex rel. Reo et al. v. Adams*, 72 N.E. Rep. 2nd Series 170 (1947) it was stated: "By resort to a writ of habeas corpus, a relator, be he defendant or witness, is entitled to the constitutional protection against being held unreasonably or in excessive bail. Relief will be granted, however, only to prevent invasion of constitutional right, not because of difference of opinion as to the amount fixed."

The fact that one judge refuses to grant a petitioner a writ of habeas corpus does not preclude him from seeking relief from another court or judge. The petition may be presented at any time of the day or night and it does not matter whether the court is in session or adjourned. The petitioner may either file his own petition or have his attorney represent him. If he is sick it is not necessary to appear in court and the person ordered to bring him to court in person is excused. One filing a petition for a writ addresses it to the judge and states where he is being unlawfully detained and who is restraining his freedom, and why he is being denied his freedom.

JOHN W. CURRAN

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**HABER, FRITZ**, 1868–1934, German chemist, was born in Breslau and studied at the universities of Berlin, Heidelberg, Zürich, and Jena and at the Charlottenburg Polytechnic Institute. He taught at the Karlsruhe Institute of Chemical Technology (1894–1911), and until 1933 was director of the Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry. About 1910 Haber discovered a means of producing synthetic ammonia. By adding oxygen to the synthetic ammonia, nitric acid could be produced. Haber organized the chemical warfare department of the Prussian War Ministry. It was responsible for the effective use of such gases as chlorine, phosgene, and mustard gas, which gained for the Germans temporary advantages in 1915 and 1917. After the war Haber attempted to extract gold from sea water. He was awarded the 1918 Nobel prize in chemistry. He also received the Rumford medal of the Royal Society of Great Britain (1932). His principal publication was *The Thermodynamics of Technical Gas Reactions* (1905).

**HABER PROCESS.** See AMMONIA.

**HABERMANN, HUGO, BARON VON**, 1849–1929, German painter, was born in Dillingen. He studied under Piloty and in 1905 became a professor at the Munich Academy. As a stylist and a colorist he has won acclaim, especially for his nudes and portraits. His better-known works include "The Monk," "Portrait of a Lady," "Portrait of a Little Girl," and the nude, "Frauenakt."

**HABINGTON, WILLIAM**, 1605–54, English poet and historian, was born in Worcestershire, and lived a quiet life of devotion to poetry and history. His verse, in the Caroline manner, was mainly devoted to the celebration of Lucy Herbert, daughter of Lord Powis, whom he married. He published his *Castara*, a collection of lyrical poems, some of rare beauty and sweetness, in 1634. Other works are: *The Historie of Edward the Fourth*; *The Queene of Aragon, a Tragicomedie*; *Observations upon Historie*.

**HABIT.** Ordinarily the term is applied to those actions of the individual that are voluntarily or involuntarily continued until they persist of themselves, thus being automatic actions. As age advances, habit predominates. The newborn child is all accommodations; a new response must be made to each new situation. With age, these accommodations become habits. Habits become linked into entire life patterns, the tremendous extent of which is unknown to the individual.

A habit is a mechanism that is absolutely essential

to human living in order that the individual may function smoothly, rapidly, and comfortably. In old age, the ability to adjust to new situations or form new habits is greatly reduced. Habit is an adaptive modification, but may be harmful as well as beneficial. Persistence of childhood habits into adult life is a universal illustration of improper adaption (see MENTAL ILLNESS). When the attention is strongly absorbed, habits emerge into action; which shows that habits are part of the unconscious behavior, and are ready to predominate whenever the inhibition due to direct cerebral supervision is relaxed.

Psychologically, habit means that mental functions once established become easier with repetition, are accompanied by feelings of familiarity, and gradually cease to be accompanied by any feeling of effort. In addition to repetition, habits are strengthened by recency and intensity or vividness; in other words, the more recent and the more intense the experience, the stronger and the more ready for action the habit becomes. Although conation, either as impulse or as conscious volitional effort, is usually prominent in the genesis of habit, unconscious habit patterns do arise in neurotic cases, the mode of origination being entirely unknown to the individual.

Habits may be aroused by familiar times, places, persons, and events. "Place habits" are those that become conditioned by the places where their activity usually occurs, i.e., the habit of eating is aroused by entering a restaurant, and the reading habit is aroused by entering a library. Habits tend to become periodic, as the return of appetite at stated intervals, the waking at a fixed hour, and, in the larger cycle, the unrest or disorganization on the recurrence of the holiday season.

In the extreme form, habit involves a certain dissociation of nerve functions. For example, the piano player who carries on a conversation while yet proceeding unconsciously, or almost so, with his playing is not far removed physiologically from the automatic planchette writer, whose habits are entirely subconscious. Habitual actions may proceed in full consciousness, yet be entirely beyond modification by consciousness. Habits originating in cravings, as for alcohol or other drugs, are frequently of this order, and tend to become entirely dissociated from conscious control, being, as it were, organic fixed ideas. See LEARNING; PSYCHOLOGY; INSTINCT; CONDITIONED RESPONSE.

**HABIT-FORMING DRUGS.** See DRUG ADDICTION.

**HABITANT**, a feudal tenant under the seigniorial system of land holding practiced in New France (Canada) until the defeat of Montcalm by the British. A bond existed between seignior and vassal in which the former, in return for granting a holding to a *habitant*, which comprised an average of 100 to 400 acres, received military service and a variety of feudal dues and rents that were not considered burdensome. Between the seignior and the *habitant* stood the royal intendant as referee to discourage abuse. Frequently the *habitant* deserted his land and his duties to lead a more adventurous life in the wilderness trafficking in furs with the Indians.

## HABITAT

*Of prime economic importance to man is a knowledge of the natural homes, the life conditions of animals and plants*

**HABITAT**, the natural abode or home of a plant or an animal. The term has remained conveniently broad and general in content. For example, one may speak of the habitat of a particular African elephant, and have in mind several square miles of tropical forest; or speak, equally correctly, of the habitat of a rat flea and refer to the rat's nest as well as to the

rodent's fur. Habitats, then, are almost as varied as the earth's surface, and are occupied by countless numbers and kinds of organisms, including both free-living and parasitic forms and ranging in size from submicroscopic viruses to the largest trees and mammals. These organisms and their habitats comprise an almost infinite series of self-regulating communities. See ECOLOGY.

**Classification.** In general terms, habitats may be classified as follows:

- I. Habitats of free-living organisms
  - A. Marine or salt-water habitats
    1. Littoral or shore
      - a. Polar
      - b. Temperate
      - c. Tropical
    2. Pelagic or surface waters
      - a. Polar
      - b. Temperate
      - c. Tropical
    3. Abyssal or depths of oceans
  - B. Brackish water habitats
  - C. Salt lake habitats
  - D. Fresh-water habitats
    1. Flowing water
      - a. Springs
        1. Hot
        2. Cold
        3. Chemical (sulfur springs)
      - b. Streams (small brooks to large rivers)
        1. Pools
        2. Rapids, waterfalls, etc.
    2. Standing water
      - a. Marsh
      - b. Bog
      - c. Ponds and lakes (polar, temperate, and tropical)
        1. Littoral or shore waters
        2. Pelagic or surface waters
        3. Profundal or depths of deep lakes
  - E. Terrestrial habitats
    1. Deserts
      - a. Ice desert
      - b. Sand desert
    2. Grasslands (steppe, prairie, savanna, meadow)
    3. Forests
      - a. Evergreen
        1. Coniferous
        2. Tropical rain forests, etc.
      - b. Deciduous
    4. Flood plains
      - a. Gravel
      - b. Sand
      - c. Silt
    5. Hypogean habitats or caves
  - F. Social habitats for nonsocial organisms
    1. Nests of termites
    2. Nests of social wasps
    3. Nests of social bees
    4. Nests of ants
    5. Human societies
      - a. Agricultural areas
      - b. Industrial areas
      - c. Dwellings
- II. Habitats of parasitic organisms
  - A. Ectoparasites (exterior of host)
    1. Of plants
    2. Of animals
  - B. Entoparasites (interior of host)
    1. Of plants
    2. Of animals

Each of the smallest subdivisions of this classification may be thought of as a very large habitat, and each holds a great many smaller habitats. For example, included within the deciduous forest category are almost innumerable types of forests, which agree in shedding their foliage largely in the autumn. An oak forest is such a habitat, but in this forest each

tree, shrub, herb, rotting log and stump is a habitat in itself, and each of these may be subdivided into still smaller habitats.

Recently the tendency is to separate the large habitats, which, in the ecological sense, may or may not be communities, from the smaller and restricted habitats. These latter are termed *habitat niches*. The habitat niche is that particular place where an animal sleeps, recuperates, or passes a regular period of inactivity. It is usually equivalent to the home of an organism.

**Residents.** Habitats may be occupied continuously by the same kinds of plants and animals (*permanent residents*) or they may be occupied by a regular sequence of different organisms through the year (*temporary or seasonal residents*). Black bears and gray squirrels are permanent residents, and migratory birds are temporary residents. Within a large habitat a given species may occupy a series of special, smaller habitats at different times of the year or at different times of the daily cycle. For example, an animal may burrow into the soil to form an *aestivaculum* in periods of drought or a *hibernaculum* in the winter, but may feed and mate over a wide territory at other times of the year. With respect to the daily cycle, the leaf mold beneath trees may be a habitat for inactive nocturnal animals during the day and inactive diurnal animals during the night. Various stages in the life cycle of a plant or animal may also require specific habitats. For example, the minute larvae or *plutei* of starfishes usually live a free-floating life near the sea surface; as the *plutei* mature, they settle to the bottom, and as adults become bottom-crawlers. Similarly, the larvae of mosquitoes are minute wigglers in fresh water, whereas the winged adults are aerial.

Some habitats, such as woodpecker nests and prairie dog burrows, may be constructed wholly or in part by the occupant. Others may be co-occupied by organisms that did not construct the habitat. This is seen in the many organisms that inhabit a coral reef built by corals, or in the abandoned snail shell appropriated by a hermit crab. On the other hand, certain habitats may not have to be constructed since they are readily available. In this respect, the fur of a mammal is an available habitat for fleas.

**Adaptations to Habitat.** Since the members of a given species of organism tend to occupy a series of similar habitat niches, they compete with one another and with organisms of different species for these habitat niches. In other words, competition for more or better shelter is both intraspecific and interspecific. It follows that the better the adaptation for certain kinds of habitat niches, the better the individual's chance of occupying such habitats.

Adjustments to habitat are of three general kinds: *structural*, *physiological*, and *behavioristic*. These are generally inherited, and consequently there is a constant selection by the environment of better and better adaptations through time. Therefore competition, whether between members of the same species or between different species, tends to the selection of optimal shelter adjustments. Both habitats and competition between organisms are involved in this long evolutionary process.

At the broadest level are the adjustments which enable animals to inhabit certain media, such as aerial adjustments for flight and aquatic adjustments for life in a watery medium. Within these broad limits there are more special adaptations which enable the species to live in a particular kind of habitat. For example, it has been found that within a stream the animals inhabiting the rapids are better adapted for the higher velocity of current and more highly oxygenated water than those animals which inhabit the adjacent deep, quiet, and relatively poorly oxygenated pools. Therefore, within the aquatic stream habitat there are the rapids dwellers with a collective adjustment to the pool habitat. Such adjustments,



structural, functional, and behavioristic, are known collectively as *mores*, and such a stream has both a *rapids mores* and a *pool mores*.

The rapids mores includes specific adjustments to two factors noted above, relatively high velocity and high oxygen content of the water. The adjustments are numerous. An entire group of fishes, known as darters, are typical dwellers in flowing water. The body of the darter is streamlined, the head is rather large, and the pectoral fins are situated near the head, so that the fish can rest firmly on the rocks, with the body swinging parallel to the force of the current and the head pointed upstream. Such fishes swim by swift, darting rushes, and brace themselves against the current with their pectoral fins. Several families of beetles (*Parnidae*, *Dryopidae*, *Psephenidae*) also live in rapids. They are all known as long-toed brook beetles because of the very long tarsal claws, by means of which they cling to the rocks. Some of these brook beetles have larvae known as "water pennies," which maintain position by the slight suction formed by their wafer-like bodies pressed to the substrate. Certain caddis fly larvae (*Hydropsyche*) anchor their tubular cases by silken strands; the case faces upstream, and a fine net is spun over the upstream entrance to catch food. Snails and limpets cling to the rocks by a flat, mucus-secreting foot. Many other adjustments to current could be cited.

Since nearly all permanent residents of aquatic habitats are heavier than water, many organisms that inhabit the surface waters of the sea must hold their positions against the pull of gravity. To maintain spatial position against this powerful physical influence numerous adjustments are necessary. The swim bladder of many fishes aids them in maintaining buoyancy. Buoyancy is achieved in the numerous single-celled animals (Protozoa) and the minute algae, known as *diatoms*, by the presence of oil globules within the protoplasm. Certain sea snails and their egg masses float near the sea surface by adhering to the surface film; other egg masses overcome gravity by incorporation into a mucus float, infiltrated with air bubbles and secreted by their parent.

A striking adjustment to gravity is found in an exclusively marine group of protozoans, the Radiolaria. Radiolarians live near the sea surface and have a silicon skeleton that is much heavier than water. Some of the species have been shown to utilize carbon dioxide to maintain their position against gravity. Although carbon dioxide gas is a waste product for most animals, these small creatures accumulate the gas in bubbles or vacuoles within their protoplasm. Since the gas is much lighter than water, they have a greatly increased buoyancy. Following storms the radiolarians escape rough wave action by rapidly excreting the carbon dioxide and sinking to a more quiet level of their habitat. Later the gas is accumulated, their buoyancy is increased, and they rise to the sea surface again.

Numerous sea surface dwellers adjust to their habitat by a seasonal change in form. Such adjustments are exhibited by certain protozoans (*Ceratium*), some rotifers, and many minute water fleas or Cladocera of the class Crustacea. Briefly, the adjustment is as follows: In winter the relatively cold water has an increased density and an increased viscosity. Although the pull of gravity remains constant, there is less tendency to sink in this denser, more viscous water. The organisms tend to have a *winter form*, i.e., individuals are smaller and more compact, and if spines or projections are typical of a species, the spines are shorter. In summer, when the relatively warm water has a decreased density and a decreased viscosity, the tendency to sink is greater, and these same species appear in a *summer form*. The individuals are larger, less compact, and their spines and body projections are longer or broader. These changes in form between winter and summer generations may be so striking that the individuals concerned appear to belong to

different species. In reality the species population has undergone a change in the relative amount of surface area in proportion to mass.

**Importance of Habitat Studies.** The subject of habitats, habitat niches, and shelter adjustments is almost as broad as is the study of biology. Discussion of a particular parasite's habitat may involve bacteriology, mycology, parasitology, medical entomology, pathology, and the treatment of disease. The production of lumber, cereal grains, packaged foods, storage of clothing, in short, most agriculture and much of industry eventually leads to an examination of habitats. The reason for this is that nearly all human activities are in direct or indirect competition with the activities of other animals and with those of plants. In order to control, or partially control, any particular organism of medical or economic importance, the habitat of such an organism must be studied, altered, or otherwise manipulated. In some cases, as in the control of yellow fever, malaria, African sleeping sickness, plague, and other diseases vectored by animals, and in the infestation of stored grain, etc., control of the organisms involved is chiefly by control of their habitat.

In addition to their other activities, organisms alter the habitats that they occupy. Man is a conspicuous example. Speaking in general terms, organisms tend to so alter their habitat through time that they render it unsuitable for further occupancy. These organisms must seek other uncontaminated habitats, while the habitat they vacate is occupied by other kinds of organisms that can tolerate and thrive in the changed conditions. (See *ECOLOGY, Community Succession*.) Apart from human activities, such gradual alteration of habitats by plants and animals through long periods of time may lead to large-scale and vital results, such as the formation of rich, organic soils. Human activities, on the other hand, especially in the modern, highly complex civilizations, usually lead to the impoverishment, deterioration, or even the destruction of good agricultural soils, lumber-producing forests, range lands, stream and lake systems, and other valuable natural resources. Therefore, study of habitats, in the special sense used here, is an important part of any scientific program of conservation. See *ZOOGEOGRAPHY*.

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**HABITUAL CRIMINAL.** See *CRIMINAL PSYCHOLOGY*; *CRIMINAL SOCIOLOGY*; *CRIMINOLOGY*.

**HABITUAL DRUNKARDS.** See *DRUNKENNESS*.

**HABSURG.** See *HAPSBURG*.

**HACHIGO ISLAND**, Japan, southernmost island of the Izu Archipelago, about 170 miles S of Tokyo; seven miles long and four miles wide; pop. about 10,000. The greatest height is an extinct volcano (2,805 ft.) in the north; the south end also rises; the lowlands between are intensively farmed. It is a picturesque island, with houses built on piles. During World War II, in February and March, 1945, its military installations were bombed by American flyers.

**HACHINOHE**, city, Japan, Honshu, Aomori Prefecture, about 40 miles SE of Aomori city. It is a port at the mouth of the Mabechi River. Pop. (1945) 77,506.

**HACHIOJI**, city, Japan, Honshu, Tokyo Prefecture, about 20 miles W of Tokyo. Near by is the Tama mausoleum of Emperor Taisho, father of Emperor Hirohito; it is the first imperial tomb erected outside the Kyoto-Nara region. The city has silk and other industries. During World War II it was over half destroyed by American superfortress bombing. Pop. (1946) 65,858.

**HACKBERRY.** See *NETTLE TREE*.

**HÄCKEL, ERNST HEINRICH.** See **HAECKEL.**

**HACKENSACK**, city, New Jersey, county seat of Bergen County, on the Hackensack River; the New Jersey and New York and the New York, Susquehanna, and Western railroads; 12 miles NW of New York, of which it is a suburb. Hackensack is an industrial city; its factories produce slippers, haberdashery, bricks, cement, furniture, chemicals, and railroad equipment. Settled in 1647 as a Dutch trading post, it has several interesting buildings of the Dutch period. During the Revolutionary War, it was raided by the British, who burned many buildings. Pop. (1950) 29,219.

**HACKETT, FRANCIS**, 1883–, American writer, was born in Kilkenny, Ireland, and was educated at Clongowes Wood College, Kildare. Coming to the United States at the age of 18, he worked for a time for a New York law firm, and then settled in Chicago, where he wrote for the *Chicago Evening Post* (1906–11). He edited the *Post's* literary page from 1909 to 1911 and was an associate editor of the *New Republic* from 1914 to 1922. His works include collections of his book reviews, as *Horizons* (1918) and *On Judging Books* (1947); racy biographical studies, as *Henry the Eighth* (1929), and *Francis the First* (1934); the novels *The Green Lion* (1936) and *Queen Anne Boleyn* (1938); and political surveys of Ireland and Denmark.

**HACKLUYT, RICHARD.** See **HAKLUYT.**

**HACKMATACK.** See **LARCH.**

**HACKNEY**, metropolitan borough and residential suburb of NE London, England, three miles NE of St. Paul's. John Howard, the philanthropist, was born here, and Defoe lived here for some time. Pop. (1950 est.) 172,720.

**HADASSAH**, the Women's Zionist organization, had about 300,000 members in the United States and Puerto Rico in 1951. Hadassah's activities include aid to Israel in the fields of medicine, social welfare, child welfare, and vocational education. The various programs are conducted through hospitals and clinics in Israel.

**HADDINGTON**, royal burg and county town, Scotland, in East Lothian, on the Tyne River, 17 miles E of Edinburgh. Jane Welsh, wife of Thomas Carlyle, is buried beneath the choir of the church of St. Mary, a red sandstone structure, dating from the 12th century. John Knox, John Brown, and his grandson, Samuel, were associated with Haddington. There are corn mills, breweries, iron foundries, manufactures of cloth and hosiery, and a large trade in agricultural products. Pop. about 4,500.

**HADDINGTONSHIRE.** See **EAST LOTHIAN.**

**HADDOCK**, a fish belonging to the same family as the cod and closely resembling it in general appearance. The haddock, *Melanogrammus aeglefinus*, has three dorsal and two anal fins, and a barbule at the point of the lower jaw. It is gray above, white below; the lateral line is black; a black spot is present behind each of the pectoral fins, these spots sometimes extending so as to meet on the back. An ancient legend ascribes these spots to the finger and thumb of St. Peter, and states the haddock to be the fish from the mouth of which he took the tribute money, the inventors of the legend overlooking the improbability of a marine fish living in the fresh water lake of Gennesaret.

The haddock is abundant almost everywhere, appearing in great shoals at particular seasons, but in size and quality the fish taken at one part of the coast differ much from those of another. The haddock, when really of good quality, is perhaps the finest of all the Gadidae, rendering it, from an economical point of view, a very important fish. It does not "take salt" so well as the cod, but is often cured by drying and smoking.

The haddock occasionally reaches the length of about three feet, but is usually under two feet. As with most fishes whose eggs are pelagic, or buoyant,

the females are more numerous than the males (the ratio is 188 to 100) and slightly larger. The food of the haddock includes crustacea, mollusks, echinoderms, and worms, and it is very fond of the eggs of the herring. It spawns in February, March, and April, at a moderate distance from the coast, or near it if the water is deep; it also spawns on the various banks in the neighborhood of Newfoundland and in the North Sea. The female sheds from about 200,000 to 1,500,000 eggs, according to her size; they closely resemble those of the cod but are a little larger, as is also the larval fish, which hatches out in from 10 or 12 to 18 days after fertilization. The female reaches maturity when three years old and is about 14 or 15 inches in length.

The distribution of the haddock is from the Arctic seas to about the Bay of Biscay on the European coast, and to Cape Hatteras on the American side. The haddock is caught principally by the trawl. While large quantities are consumed fresh, haddock is also smoked on a large scale, especially in Europe, as "finnan haddie," named from Finnan or Findon, in Kincardineshire, Scotland.

**HADDON HEIGHTS**, borough, SW New Jersey, Camden County, on the Pennsylvania-Reading Seashore Railroad and U.S. Highway 30, about five miles SE of Camden of which it is a residential suburb. The borough was named for John Haddon, an English Quaker, whose daughter, Elizabeth, founded **HADDONFIELD**. Pop. (1950) 7,287.

**HADDONFIELD**, borough, SW New Jersey, in Camden County, on the Pennsylvania and the Pennsylvania-Reading Seashore railroads, six miles SE of Camden, of which it is a residential suburb. It was founded by Elizabeth Haddon, a Quaker girl of 20 who was sent here in 1710 by her father to develop 400 acres of land. The Indian King Inn, where New Jersey's first legislature met in 1777, is still standing. Pop. (1950) 10,495.

**HADEN, Sir FRANCIS SEYMOUR**, 1818–1910, English etcher, was born in London and educated as a surgeon. He practiced his profession most successfully, and was instrumental in founding a hospital for incurables, but in 1858 he took up the art of etching, and did much toward its revival. His work is vigorous and spontaneous, rather than exquisite and is characterized by great individuality. He was a brother-in-law of the artist Whistler. Among his best known productions are "Mytton Hall," "Erith Marshes," "Calais Pier," and the "Breaking Up of the Agamemnon." He was the founder of the Royal Society of Painter Etchers. His books include *Etched Work of Rembrandt* (1879), and *About Etching* (1879).

**HADERSLEV**, county, Denmark, in North Schleswig, S Jutland, bounded on the E by the Little Belt, on the S by Aabenraa County SW by Tønder, NW and N by Ribe, and NE by Vejle; area 518 sq. mi.; pop. (1945) 67,493. Grain and forage crops and livestock are raised. Industries include brewing, tanning, engineering and iron works, and fishing. The chief city and seaport is **HADERSLEV**.

**HADERSLEV**, German **Hadersleben**, seaport, Denmark, North Schleswig, in Haderslev County, on the NE coast of S Jutland, 40 miles N of Flensburg, Germany. Its chief industries include engineering works, breweries, iron foundries, tobacco factories, lumberyards, fisheries, and tanneries. Pop. (1945) 17,583.

**HADIS**, in Greek mythology, the abode of departed spirits who had not merited admission to Elysium. In Homer, Hades refers to both the underworld and its ruler, the son of Cronus and Rhea. He was a grim, severe deity, but was not malevolent. To enter his kingdom the spirits of the dead were obliged to cross the river Styx in a ferryboat rowed by Charon, who charged a small fee. If, by any chance, a body had remained unburied, the soul had to wander for a hundred years on the hither side of the Styx before it was taken across. Beyond the gates



of Hades, guarded by the three-headed dog, Cerberus, sat the judges Minos, Rhadamanthus, and Aeacus who determined the soul's final abode. See HELL.

**HADHRAMAUT**, biblical **Hazarmaveth**, a vague region under British supervision and consisting of the Qu'aiti State of Shihr and Mukalla and the Kathiri State of Saiun (Seiyun), along the S coast of the Arabian Peninsula in E Aden Protectorate, area about 100,000 sq. mi.; pop. about 500,000. The region is largely desert but near the coast there is a high mountain range. The coast line extends from Oman on the east to Yeman on the west along the Gulf of Aden; the limits on the north, where Hadhramaut shades into the Empty Quarter, are uncertain. Valleys between the mountains (some of which rise to 6,000 feet) produce wheat, tobacco, fruits, and dates. There is trade in myrrh, frankincense, aloes, carpets, linen, shawls, and girdle knives. The ancient Arabia Felix comprised Yemen and the Hadhramaut. British supervision operates through the governor of the crown colony of Aden; resident advisers are stationed at Mukalla and Saiun, capitals respectively of the Qu'aiti State and the Kathiri State. See ARABIA.

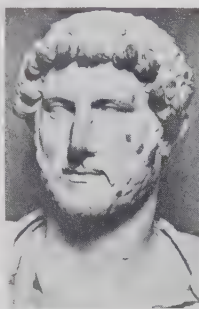
**HADLEY, ARTHUR TWINING**, 1856-1930, American economist and educator, was born in New Haven, Conn., and studied at Yale and the University of Berlin. He joined Yale's staff as a tutor in the college (1879-83), lectured in the university on railroad transportation (1883-86), and was professor of political science (1886-91) and of political economy (1891-99). He was president of Yale University from 1899 to 1921. Hadley's *Railroad Transportation, Its History and Its Laus* (1885) and *Economics: An Account of the Relations Between Private Property and Public Welfare* (1896) made him famous as an economical theorist. He was asked to advise the Cullom committee of 1885, which prepared the Interstate Commerce Act; was commissioner of labor statistics in Connecticut from 1885 to 1887, chairman of the U.S. Railroad Securities Commission (1910), and chairman of the Hadley Committee appointed to investigate railroads in 1911. A popular guest lecturer, Hadley was Roosevelt professor at Berlin (1907-08), and lectured at Oxford in 1914. His writings include *Some Influences in Modern Philosophic Thought* (1913); *Undercurrents in American Politics* (1915); *The Moral Basis of Democracy* (1919); *Economic Problems of Democracy* (1923); *The Conflict Between Liberty and Equality* (1925).

**HADLEY, HENRY KIMBALL**, 1871-1937, American composer, was born in Somerville, Mass. After studying with teachers in America, he continued his work abroad. In addition to his composing he was a conductor of note in Europe and in America, holding positions with the Seattle, San Francisco, and New York symphony orchestras. Though he is known for such compositions as his opera *Cleopatra's Night* (1918), his symphony *The Four Seasons* (1901), and his chamber music, it was his efforts to further American music that make him an important figure. He organized the Manhattan Symphony in New York which included the works of American composers on many of its programs, and he was active in the American Society of Composers, Authors, and Publishers.

**HADRIAN**, born **Publius Aelius Hadrianus**, A.D. 76-138, emperor of Rome (117-138), officially styled *Imperator Caesar Traianus Hadrianus Augustus*, was born near Sevilla, Spain. He had an excellent education and was well versed in all the intellectual and material refinements of the Graeco-Roman civilization. He had natural administrative genius, holding numerous offices in turn during the reign of Emperor Trajan, whose ward he was. He accompanied him in his wars and was legate of Syria, commanding the armies of the East in the Parthian War when Trajan died.

The army acclaimed him and the Senate confirmed his accession despite doubts of his legal rights, since he had never been officially adopted by Trajan. The

latter's wars had almost ruined Rome financially. Hadrian gave up three eastern provinces, pacified the wild border tribes, and devoted himself to organizing the provinces, restoring the agricultural population, eliminating graft, extending social service, humanizing the status of slaves, and stimulating culture and the arts. His great administrative achievement was the regulation of the judiciary, accomplished by promulgating the *Edictum perpetuum* collected by Julius Salvianus. Parts of this



Hadrian

were incorporated in Justinian's *Corpus juris* and thus are embodied in modern legislation, in so far as it is based upon Roman law. He protected Britain by constructing **HADRIAN'S WALL** (122-124).

He spent much of his time in travel, surveying and studying the empire's needs. His progress was marked by new cities, aqueducts, temples, libraries, theaters, and roads. He was known for his mania for building; in the words of the ancients: "In nearly every town he did some work of construction." A lover of Greek culture, he rebuilt Athens. His most famous buildings are the Pantheon and his mausoleum (*moles Hadriani*), later called *Castel Sant' Angelo*; both still exist in Rome.

When he came to Palestine, the Jews expected him to rebuild Jerusalem and the Temple. Instead, they learned that he intended to replace the destroyed Jewish Temple with a temple to Jupiter. Thereupon a horrible revolt broke out against the Romans, the Jews being led by Bar Kochba. It took the Romans three years (132-135) before their general, Gaius Julius Severus, finally, with utmost severity, crushed the revolution. Hadrian then rebuilt Jerusalem under the name Aelia Capitolina and forbade the Jews to live there.

On his last journey Hadrian was deeply grieved by the death of his favorite ANTINOUS, whose beauty gave a new art type to later Roman Sculpture. See ITALY for illustration of Hadrian's Tomb.

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**HADRIAN'S WALL**, about 74 miles long from Wallsend on the Tyne River to Bowness on Solway Firth, was begun by command of the Emperor **HADRIAN**, who visited Britain A.D. 122. Later, the wall was strengthened and extended, especially by **SEVERUS** in 209. Along most of its course the wall was built of stone but its westward section was of turf. South of the wall was a broad ditch, and farther back a chain of about 19 forts. For generations this fortified line protected Roman Britain from hostile tribes. The wall was abandoned about 383.

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**HADROSAURUS**, a genus of herbivorous, duck-billed dinosaurs, most prominent of ornithopods in the Upper Cretaceous of North America. Hadrosaurs averaged 30 feet in length, were unarmored, had numerous small teeth, a stout tail, strong hind legs and webbed feet with three digits terminating in hoofs. They were amphibious in habits.

**HAECKEL, ERNST HEINRICH**, 1834-1919, German biologist, was born in Potsdam and studied at the universities of Würzburg and Berlin. In 1865 he became professor of zoology at the University of Jena and held this position until 1909. He was one of the first Germans to accept the Darwinian doctrine of evolution and drew up genealogical trees to show the descent of various orders of animals. He also

formulated the biogenetic law that the development of the individual animal is a recapitulation of the development of the species to which it belongs. Out of this generalization he developed the *gastrea* theory in accordance with which the animal creation was divided into unicellular and multicellular animals; the common ancestor of the latter was the hypothetical *gastrea* or *gastrula*. (See EMBRYOLOGY.) His views as to the evolution of organic life from the albuminoid compounds of carbon were set forth in *Die Welträtsel* (1899). His *Generelle Morphologie der Organismen* (2 vols. 1866) contains in germ much which has been subsequently put forward by other morphologists.

**HAEMUS.** See BALKAN PENINSULA.

**HÂFIZ**, real name **Mohammed Shams ed-Din**, d. 1388, the greatest of Persian lyrical poets, was born in Shiraz early in the 14th century. Scarcely any details of his life are known; all that is certain is that he lived in Shiraz in retirement and literary ease, died and was buried there. At one time he joined an order of dervishes, but the restraints of asceticism proved distasteful. His fame as a poet spread through all Mohammedan lands. His chief work is a collection (*Divan*) of short odes, or *ghazals*, arranged in couplets and following each other in alphabetical order. They celebrate wine and women, and are of a fervidly sensuous nature. Oriental commentators, however, regard them as purely mystical, and to be interpreted according to the rules of the Sufi philosophy.

**HAFNARFJORDUR**, town, SW Iceland, S of Reykjavik. It has a good harbor and is a shipping center. Pop. (1949 est.) 4,699.

**HAFNIUM** is a metallic ELEMENT that was discovered in 1923 by D. Coster and G. von Hevesy. It is used in the filaments of radio tubes because it gives up ELECTRONS readily and melts at about 1700° C. The symbol for hafnium is Hf. Its atomic weight is 178.6 and its atomic number is 72. The metal has a valence of +4 and resembles ZIRCONIUM in its chemical conduct.

**HAGAR**, the handmaiden of Sarah and mother of Abraham's eldest son, Ishmael, was of Egyptian origin. Her flight, as recorded in Gen. 16, and her expulsion, ch. 21, are from the Jahvistic and Elohist sources, respectively, and present interesting points of comparison. She was regarded as the ancestress of the Hagarenes or Hagarites (I Chron. 5: 10), and Paul uses her as a type of the old covenant (Sinai) and the earthly Jerusalem (Gal. 4:25). See ABRAHAM.

**HAGEN, WALTER**, known as the **Haig**, 1892–, American golfer, was born in Rochester, N.Y. One of the world's great golfers, he dominated United States professional play in the 1920's. He won the U.S. National Open (1919); British Open (1922, 1924, 1928–29); U.S. Professional Golfers' Association championship (1921, 1924–27).

**HAGEN**, city, W Germany, in North Rhine-Westphalia, in former Prussian province of Westphalia, on the Ennepe River about 30 miles ENE of Düsseldorf. Hagen is an important steel-producing center and the gateway to the Sauerland. Its manufactures include hardware, paper, electrical machinery, and cigars. Limestone is quarried in the vicinity. In the districts surrounding the city are many pleasant outing spots. Hagen was founded in the 14th century and became a town in 1718. It was heavily bombed in World War II. Pop. (1946) 126,516.

**HAGENBECK, KARL**, 1844–1913, German animal trainer and circus director, born in Hamburg. In his early twenties, he was given control over his father's collection of wild animals. Initiating expeditions, he expanded the collection into an internationally known business. His trained animals were exhibited throughout the European countries and in the United States. In 1902 he acquired a large

tract of land at Stelligen, near Hamburg. There he established his famous Animal Park, designing it to be a "natural surrounding" for his animals.

**HAGERSTOWN**, city N Maryland, county seat of Washington County, near Antietam Creek on the Baltimore and Ohio, the Norfolk and Western, the Pennsylvania, and the Western Maryland railroads, the All-American Airways, and on U.S. highways 11 and 40, about 65 miles NW of Baltimore and five miles from the Pennsylvania line. The city lies almost in the center of Hagerstown Valley, an agricultural community, near the entrance to the Shenandoah and Cumberland valleys. It was settled in 1737 by Jonathan Hager, who named his home "Hager's Delight." In 1814 the settlement was incorporated as Hager's Town, now spelled as one word. There are manufactures of pipe organs, flour, sandblasting equipment, cement, airplanes, shoes, and paper boxes. Pop. (1950) 32,260.

**HAGFISH**, a fish of the class CYCLOSTOMATA, related to the LAMPREYS. Of the two genera and about five species of hags, the best known is the slime eel, *Myxine glutinosa*, of the North Atlantic. Hags are strictly marine and prefer the colder waters. They are long, slender, slimy, eel-like fishes without jaws, scales, or paired fins. Hags are distinguished from lampreys by the presence of several barbels (slender, fleshy projections) on the snout, the absence of eyes, and in having the gill openings in the body wall at some distance from the head. There are other more technical characteristics.



Hagfish are distinguished by presence of barbels on the snout

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Hagfish are considered the most primitive of all living vertebrates, being ranked below the closely related lampreys chiefly because they possess only one pair of semicircular canals in the inner ear in contrast to two pairs in the lampreys and three pairs in all other vertebrates. One family of hags, the *Heptatremitidae*, have from 6 to 14 pairs of gill openings, but the *Myxiniidae* have only one pair. The single pair of gill openings, in contrast to the seven pairs present in all lampreys, readily distinguishes the Atlantic hags from lampreys.

**HAGGAI**, a prophet of Israel who lived in the early years of the restoration from the Captivity. The exiles had returned in 536 B.C., but the work of building the Temple remained in abeyance until 520 B.C., when Haggai arose to urge Joshua and Zerubbabel to proceed with the task without delay. Haggai prophesied that the dearth then upon the land was due to the divine displeasure with the settlers for adorning their own houses while the house of God remained unfinished.

**HAGGARD, Sir HENRY RIDER**, 1856–1925, English novelist, was born in Bradenham, Norfolk. In 1875 he was appointed secretary to Sir Henry Bulwer, governor of Natal, and in 1877 acted on the staff of Sir Theophilus Shepstone, special commissioner to the Transvaal. Upon the annexation of the Transvaal (1877), in which he assisted, he became master of the high court (1878). He was specially commissioned by the government to study the Salvation Army colonies in the United States and at Hadleigh, England, together with a scheme of national land settlement, and issued his report in 1905. In 1912 he was knighted. He was the author of numerous adventure stories, usually with a South African background. The most popular of these were *King Solomon's Mines* (1886); *She* (1887); *Allan Quatermain* (1888);



*Cleopatra* (1889); *Montezuma's Daughter* (1894); *Ayesha* (1905); *When the World Shook* (1919); *The Ancient Allan* (1920).

**HAGI**, port, Japan, SW Honshu, Yamaguchi Prefecture, about 15 miles N of Yamaguchi city. Following the middle of the 19th century, Hagi was prominent in the imperial restoration movement. Pop. (1946) 39,704.

**HAGIOGRAPHIA**, "sacred writings," the Greek name for the last of the three divisions of the Jewish Scriptures (Old Testament), the other two divisions being The Law and The Prophets. In Hebrew the books are known as *Kethubim* ("writings"). The Hagiographa is divided into three groups of writings: (1) the poetical books—Psalms, Proverbs, and Job; (2) the Megilloth ("rolls")—Canticles, Ruth, Lamentations, Ecclesiastes, and Esther; (3) Daniel, Ezra, Nehemiah, and I and II Chronicles. See BIBLE.

**HAGIOGRAPHY**, writings which are concerned with the study of the lives of holy persons and saints. The earliest such writings consisted chiefly of lists of martyrs and saints, the dates of their martyrdom or death, and the feasts assigned to them. Later, more complete accounts were written of their lives and sayings. The BOLLANDISTS were the first to organize the collections on a systematic basis, beginning with the *Acta Sanctorum* ("Lives of the Saints") which were collected and published from 1643 to 1794. In 1892 a reorganized Bollandist association published 65 volumes of hagiography, each volume containing about a thousand pages of closely printed material. See SAINT.

**HAGONOY**, town, Philippine Islands, on Luzon, in Bulacan Province, 25 miles NW of Manila, on the W branch of the Pampanga Delta. There are manufactures of alcohol, nipa thatch, hats, furniture, and tanning. The town was founded in 1581. During World War II it was taken by United States troops on Feb. 20, 1945. Pop. (1948) 37,532.

**HAGUE, THE**, Dutch 'sGravenhage or Den Haag, governmental capital of the Netherlands, capital of South Holland Province, two miles from the North Sea and 15 miles NW of Rotterdam. Pop. (1950 est.) including the seaside suburb of Scheveningen, 558,849.

**Features of Interest.** One of the handsomest cities in the country, The Hague is intersected by canals and shady avenues of lime trees and has many fine structures. In the center of the city is the artificial lake known as the Vijver, around which are grouped many noteworthy public buildings. To the south is the old castle of the counts of Holland, consisting of an outer and an inner court; in the latter are the 13th-century Gothic knights' hall and the chambers in which the Dutch Parliament holds its sittings. On one side of the outer court (Buitenhof) stands the Gate Tower, which was formerly used as a state prison. Noteworthy institutions are the picture



NETHERLANDS INFORMATION BUREAU  
**Equestrian Statue of William I, or William the Silent, stands before Royal Palace in The Hague**

gallery, the most precious possession of the city, containing works by Rembrandt, Potter, Jan Steen, Douw, Ostade, Van de Velde, Holbein, Ruisdael, Vermeer, Murillo, Velasquez, and others; the Municipal Museum, containing a good collection of Dutch pictures; Mesdag's famous collection, the Maurits Huis, made over to the nation; and the Ethnographic Museum, rich in Chinese and Japanese articles.

North of the Vijver are the Royal Palace, the Royal Library (over 500,000 volumes), and in the center of the large square "Plein 1813" the national monument commemorating the recovery of Dutch independence in 1813. West of the same central sheet of water stand the "Great Church" of St. James, a Gothic structure of the 14th century, and the picturesque Town Hall. The New Church (1649), which stands some distance south of the Vijver, contains the tombs of the two De Witts and of Spinoza.

The Palace of Peace, completed in August, 1913, is an imposing brick and stone structure 260 feet square, with a 250-foot tower. The Great Court Hall is 70 feet long, 40 feet wide, and 33 feet high. It is the seat of the International Court of Arbitration, established in 1899. The beautifully landscaped grounds surrounding the palace (in addition to other sites in the city and suburbs) were used by the Germans (1940-45) for launching robot bombs and stratosphere rockets against England during World War II. Many of these deadly missiles fell into, and badly damaged, buildings in the city and killed thousands of civilians. Every window of the palace was shattered.

To the east of the town is a park called *Haagsche Bosch*, or the wood, in which stands a royal residence (1647) with the magnificent "Orange Hall." Here the international peace conferences met in 1899 and 1907 (see HAGUE CONFERENCES). Only a few trees of this famous old 17th century wood survived the German occupation during World War II.

Principal industries of The Hague are iron foundries, copper and lead smelters, an arms works, printeries, railway coach and furniture factories, and manufactures of gold and silver lace and decorations.

**History.** The Hague did not acquire importance until the 16th century. In 1527 it became the seat of the supreme court in Holland, and in 1584 the meeting place of the states of Holland and states-general, and the real capital of the Netherlands; it was also

**The Maurits Huis contains a fine collection of Dutch paintings. Vijverberg Gallery is at the right**

NETHERLANDS INFORMATION BUREAU



## Hague Conferences

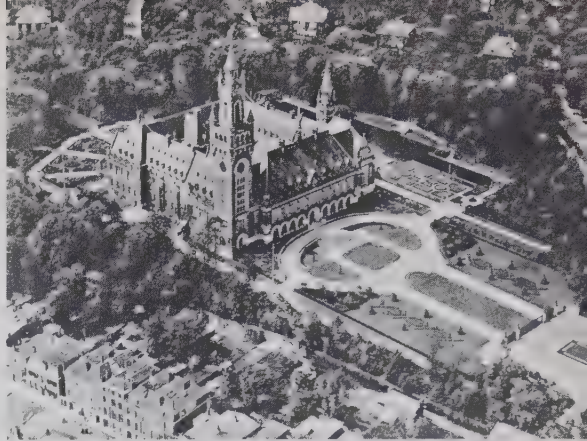
the residence of the *stadtholders*. Here many treaties have been signed and diplomatic conferences held, such as the treaty between Spain and the Netherlands (1609); the treaty of alliance between the Netherlands and Denmark (1666); the Triple Alliance between England, Sweden, and the Netherlands (1668); the concert among Holy Roman Empire, England, and the Netherlands (1710); the Triple Alliance between France, England, and the Netherlands (1717); and the peace between Spain, Austria, and Savoy (1717). The Hague was the first Dutch city seized by the Germans in their surprise invasion of the Netherlands, May 10, 1940. In the winter of 1942-43, entire sections of the city were ruthlessly demolished—more than 20,000 buildings, including the entire suburb of Scheveningen—to make room for Hitler's "Atlantic Wall," a two-mile deep fortification of big gun mounts, tank traps, mine fields, and barbed-wire entanglements, built for defense against the expected Allied invasion. The city suffered greatly during the last winter of the war; it was finally liberated with the German surrender in May, 1945. K. E. H.

**HAGUE CONFERENCES.** The Hague Conferences had their origin in the desire of Nicholas II, Emperor of Russia, to initiate measures looking toward "the maintenance of the general peace, and a possible reduction of the excessive armaments which were burdening all nations." His suggestion to accomplish these purposes by an international conference was laid before the diplomatic representatives accredited to St. Petersburg by Count Mouraviev, the Russian foreign minister, in a circular letter of Aug. 24, 1898, and followed up in another letter of Jan. 11, 1899, addressed to the Russian representatives accredited abroad. The suggestion was taken up by the various governments, and on May 20, 1899 delegates from 26 states met at The Hague in response to the invitation of the government of the Netherlands.

**The First Conference** failed to achieve any limitation of armaments, but addressed itself, with some degree of success, to the other questions brought before it. The work of the conference was set forth in the Final Act, signed July 29, 1899, by the delegates of all the states participating. This final act specified, as the actual results of the Conference, three conventions and three declarations, each of which was to be a matter for separate ratification. The first convention provided for the pacific settlement of international disputes, an instituted means for such settlement in Commissions of Inquiry and a Permanent Court of Arbitration, accessible at all times to the contracting powers. Rules of arbitral procedure were formulated, and provision made for the constitution of tribunals from the members of the Permanent Court—which is not a court at all, in the ordinary meaning of that word, but a panel from which arbitral tribunals may be chosen on request of the parties at variance. The second convention was a formulation of the laws and customs of war on land "with the view of defining them more precisely, or of laying down certain limits for the purpose of modifying their severity, as far as possible." The third convention adapted to maritime warfare the principles of the GENEVA CONVENTION of 1864.

The declarations were attempts to mitigate modern warfare by prohibiting (1) the discharge of projectiles and explosives from balloons, or by other similar new methods; (2) the use of projectiles the only object of which is the diffusion of asphyxiating or deleterious gases; and (3) the use of bullets which expand or flatten easily in the human body. The last two declarations were not ratified by the United States government.

In addition, the First Conference adopted a resolution calling for the restriction of military budgets, and gave expression to six wishes on various subjects upon which international action was considered desirable. Two of these wishes—that regarding the rights and duties of neutrals, and that regarding



NETHERLANDS INFORMATION BUREAU

**Peace Palace at The Hague, built to house the Court of International Justice, was erected in 1913**

naval bombardment—were embodied in conventions at the Second Conference in 1907, and another—calling for the revision of the Geneva Convention—was carried out in 1906.

The wishes of the First Conference implied that a later conference would complete its work. Nothing was done in this direction, however, until Oct. 21, 1904, when President Roosevelt took the initiative through a circular letter addressed by John Hay, secretary of state, to the American representatives accredited to the governments signatory to the Hague Convention of 1899. In this letter a second conference at The Hague was suggested, but no specific program was indicated. The proposal was not acted upon immediately because of the Russo-Japanese War; but on the termination of that conflict the Second Peace Conference was convoked by the czar, to whom President Roosevelt had yielded the honor of summoning it, because of the expressed desire of the czar to be associated with the Second Conference as he had been with the first.

**The Second Conference** met in the summer of 1907, and was attended by the representatives of 44 states. Its Final Act of October 18 enumerates, as its definite work, 13 conventions and one declaration. The three conventions of 1899 were revised, significant additions being made especially in the convention for the pacific settlement of international disputes. The Permanent Court had proved to be the most fruitful work of the First Conference, and there had been four cases referred to it between 1899 and 1907—the United States and Mexico having been the first to have recourse to it, in 1902, in the case of the Pious Fund of the Californias. But experience had suggested improvements, and the revision of 1907 embodied them, especially regarding the language to be used, and the restriction upon the employment of members of the Permanent Court as counsel in cases before it. Further, the provisions for Commissions of Inquiry were much amplified, chiefly as a result of their successful application in the Dogger Bank incident between Russia and Great Britain (1904).

Aside from the convention limiting the employment of force for the recovery of contract debts, the new conventions of 1907 sought to regulate war rather than to prevent it. Among the matters upon which agreement, more or less specific, was reached were the opening of hostilities, the laying of automatic submarine contact mines, the status of enemy merchant ships at the commencement of hostilities, restrictions on naval capture, the rights and duties of neutrals in war on land as well as in naval warfare, and the creation of the International Prize Court.

The three conventions of the 1899 conference were ratified by practically all the signatory states. The 1907 conventions, however, did not fare so well; the convention providing for the International Prize Court did not receive a single ratification; for the



others ratifications ranged from about 50 per cent to 70 per cent. Many of the conventions specifically provided that their terms should not apply to any war in which nonratifying states were belligerents; for this reason none of the conventions governing conditions in war was strictly binding during World War I, since Italy and Turkey among other states had failed to ratify any of the documents. Nevertheless the conventions did have considerable moral force; moreover it was generally held that most of the provisions were merely declaratory of existing practice.

The two Hague conferences represented a laudable, if futile, effort to arrest the drift toward world war. They were significant also because of the beginning which they made in international legislation. The Permanent Court of Arbitration, while never of great significance in its own right, did help to pave the way for the Permanent Court of International Justice under the League of Nations.

The 1907 conference like its predecessor gave expression to certain wishes, among them the wish that the laws and customs of naval warfare be formulated in a convention similar to that for war on land. This wish eventuated in the London Naval Conference of 1908-09, which drew up the unrati-fied Declaration of London. Another wish incorporated a draft convention for a Judicial Arbitration Court, which it was hoped might become a permanent institution; nothing came of this suggestion. The concluding wish was a recommendation that a third conference should be held in eight years after careful planning and preparation. In 1914 plans were beginning to be made for the new meeting but the outbreak of the World War prevented their fulfillment.

No sweeping generalization can be made as to the present validity of the various Hague Conventions after two World Wars. Apart from the fact that they were never universally ratified, and therefore in a major war they are technically not binding on the belligerents, they are generally regarded as declaratory of the best current practice in international law. Hence provisions of the conventions are still often cited as one source of the law of nations, but always subject to rebuttal on the grounds that changed conditions of social and economic life and new methods of warfare have outmoded the rules based on conditions prevailing in 1907. See INTERNATIONAL LAW; WAR, LAW OF; ARBITRATION, INTERNATIONAL; DISARMAMENT; PEACE; COURTS, INTERNATIONAL; UNITED NATIONS; LEAGUE OF NATIONS.

G. B. DE H.

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**HAGUENAU**, German *Hagenau*, town, France, in the department of Bas-Rhin, on the Moder River, 15 miles N of Strasbourg, near the Forest of Haguenau. Its features of interest include the Romanesque St. George's Church (1184), the Church of St. Nikolaus (13th to 15th centuries), the Chancellery (15th century), now used as a public library, and numerous old houses. The German emperor, Frederick Barbarossa, frequently sojourned here. The town's industries include hop culture and trade, and the manufacture of textiles, shoes, porcelain, soap, and beer. Haguenau was founded near the hunting lodge of the duke of Swabia, Frederick the One-Eyed (1090-1147). It became a city in 1164. An imperial city from 1257 to 1648, it became French by the Treaty of Westphalia. In 1871 it fell to Germany and in 1918 it was returned to France. Germany again held the town during World War II. Pop. (1946) 17,337.

**HAHA ISLAND.** See BONIN ISLANDS.

**HAHN, OTTO**, 1879- , German physical chemist and radiologist, was born in Frankfort on the Main. Appointed an instructor in physics at the Kaiser Wilhelm Institute for Chemistry in Berlin-

Dahlem in 1906, he was promoted to professor in 1912 and director in 1928. After 1924 he was a member of the Prussian Academy of Sciences.

Hahn was a pioneer in the field of radioactivity, discovering radiothorium in residues from the mineral thorianite (1905) and showing that mesothorium and mesothorium 2 are intermediate disintegration products between thorium and radiothorium (1906). In 1917 he collaborated with LISE MEITNER in the discovery of protoactinium, and in 1921 announced the existence of another radioactive product, uranium Z. As a result of further research with Miss Meitner in 1935 he described the beta-ray activity of nine radioactive products resulting from the bombardment of uranium with neutrons.

While subjecting a uranium isotope (U-235) to neutron bombardment in 1939, Hahn and his assistant, F. Strassmann, found



ACME

Otto Hahn

that about 200,000,000 electron volts of atomic energy could be released through the fission or rupturing of the nucleus of the uranium atom. He also discovered that one of the fission products resulting from this nuclear rupture was an isotope of barium (element 56). The experiment marked the beginning of the research on the practical release of atomic energy which led to the production of the atomic bomb by American

physicists. For making such a significant discovery Hahn was awarded the 1944 Nobel prize in chemistry.

M. E. C.

**HAHNEMANN, SAMUEL**, in full, *Christian Friedrich Samuel*, 1755-1843, German physician, was born in Meissen, Saxony. While practicing in Leipzig after 1789 he conceived the idea that various illnesses could be cured by administering in small amounts the drugs which when given to a healthy person in large amounts produced similar symptoms. He gave the name HOMEOPATHY to this system of medicine and expounded its principles in *Organon der rationellen Heilkunst* (1810). The school which he founded first in Leipzig and then in Köthen, under the protection of the duke of Anhalt-Köthen, was attended by students who introduced this system in the United States and other countries.

**HAIDARABAD.** See HYDERABAD.

**HAIFA**, or *Khaifa*, city, N Israel, on the S shore of the Bay of Acre on the Mediterranean, at the foot of Mount Carmel; nine miles SW of Acre. The city is Israel's leading seaport and a thriving industrial center; its growth has been recent. Haifa came under British control after the end of World War I, when Palestine was captured by the British. Since 1939, when Jewish refugees from war-torn Europe began to pour into Palestine and 60,000 of them settled in Haifa, the town has grown into an important port and metropolis. It has wide streets, beautiful modern public buildings and dwellings, and suburbs spreading up the slopes of Mount Carmel. The harbor has been dredged to a depth of 30 feet, with huge breakwaters driven into the sea. The large quay and docks built on reclaimed land accommodate ocean vessels and have increased shipping. As the terminus of a 600-mile oil pipe line from Iraq, finished in 1933, Haifa is also a refueling station for ships. Railway lines from Egypt, Turkey, Damascus, and other points of the Near East meet here. There are an airfield, a seaplane landing harbor, and a broadcasting station. A nautical school, founded in 1918, is maintained to create a body of capable seafaring men among Jewish boys. The Haifa Technical Institute includes departments of architecture, civil, industrial, and chemical engineering. Industries include oil refineries, flour mills, cement



P.P.C.-GIDAL

### Ruthenberg Power Plant is a modern development in Haifa, industrial center in Palestine

works, canneries, machine shops, metal works, power plants, and cigarette, soap, and textile factories. Mineral salts and compounds procured from the Dead Sea, especially those chemicals needed for agriculture, are exported all over the world. Following the United Nations decision to partition Palestine (December, 1947), Haifa became one of the principal centers of conflict between Jews and Arabs. Between 1948 and 1950, the population of Haifa more than doubled, necessitating an intensive housing program. Pop. (1950 est.) 155,000.

K. E. H.

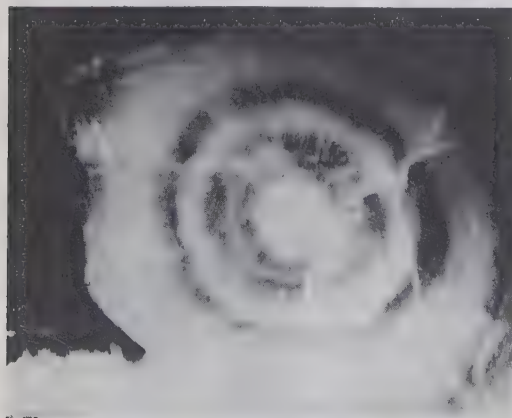
**HAIG, Sir DOUGLAS, 1st EARL HAIG, 1861–1928**, British general, was born in Edinburgh, Scotland, and educated at Brasenose College, Oxford. He took part in the Nile campaign in 1898, and in the Boer War (1899–1901), gaining a colonel's brevet. He was lieutenant colonel of Lancers (1901–3), inspector general of cavalry in India (1903–6), director in the War Office (1906–9), chief of staff in India (1909–12), and general officer commanding at Aldershot (1912–14). At the beginning of World War I he became commander of the First Army in France (1914–15), being promoted to full general in 1914. He succeeded Sir John French in 1915 as commander in chief of the entire English forces in France. It was Haig who in 1918, during the height of the German offensive, appealed to the British to fight "with their backs to the wall." His army broke through the Hindenburg line in the same year. He was created earl in 1919, and devoted his last years to the interests of war veterans. See **EDINBURGH** for illustration.

**HAIGHT, CHARLES COOLIDGE, 1841–1917**, American architect, was born in New York City. Wounded in the Civil War, he then worked in the architectural office of Emlen T. Littell, opening his

own New York office in 1867. One of the earliest architects to adapt Gothic to American school architecture, his educational buildings are dignified yet functional, as Hamilton Hall, Madison Avenue Campus, Columbia University, and the Yale Library. His other notable buildings include the Lawyer's Title Insurance Company Building, the General Theological Seminary, and the Cancer Hospital, all in New York City.

**HAIL**, in meteorology, precipitation in the form of balls or irregular forms of ice, snow and, sometimes, frost. Generally it is distinct from *small hail*. Hailstones are usually only roughly spherical, and may be of cone or pyramid form. Sizes vary from small pellets to large chunks. The largest hailstone recorded in the U.S. fell at Potter, Neb., in July of 1928. It measured 17 inches in circumference and weighed one and one-half pounds. At Cazorla, Spain, in June of 1929, chunks of ice weighing four and one-half pounds are reported to have crushed some of the houses. Hail can be very destructive to cattle and other creatures on the open range. Ordinary hail is disastrous to crops, particularly to small plants, berries and grapes. Insurance against loss by hailstorms is commonly carried by growers in areas where such storms are to be expected occasionally. Hailstorms are real hazards in aviation.

Hail is most likely to fall at the front of violent or longdrawn thunderstorms; never when the surface air temperature is below freezing. The hailstone is built in layers of ice and snow. The front of the violent thunderstorm presents high velocity updrafts which are irregular and puffy. The raindrops falling within these currents are tossed into the upper regions where the temperatures are below freezing, becoming ice.



U.S. WEATHER BUREAU

Structure of large hailstone, left; size of hailstone from Oklahoma storm, July, 1940, right



In time they reach a less turbulent space and again fall to a wet region where moisture freezes on their icy surfaces. They may be caught once more, or repeatedly, in the mounting currents and each time gain another layer of ice or snow. Finally their weight carries them through to the ground. When hailstones have not repeated their rocketing they fall as clear ice particles. See METEOROLOGY; WEATHER; SNOW; STORM.

V. L. S.

**HAIL MARY.** See AVE MARIA.

**HAILE SELASSIE**, royal name of **Ras Tafari Makonnen**, 1893–, emperor of Ethiopia (Abyssinia), the son of a distinguished soldier and diplomat and the great-grandson of Haile Melekot, king of Shoa. He was educated at a French school at Harrar. When his aunt became empress in 1916 he was appointed regent. In 1928 he became king of Shoa and after the death of the empress became emperor on Nov. 2, 1930. He abolished slave trading and declared that the children of slaves should be free. He also created a constitutional legislature. When Italy invaded Ethiopia, Haile Selassie appealed to the League of Nations for assistance. On May 1, 1936, the emperor fled from Addis Ababa. Four days later the Italians occupied the city and proclaimed King Victor Emanuel emperor of Ethiopia. In 1941 British troops expelled the Italians, and Selassie returned to the throne in May. In 1950 the United Nations voted to include Eritrea, former Italian colony, with Ethiopia under the crown of Haile Selassie.

**HAILMANN, WILLIAM NICHOLAS**, 1836–1920, American leader of the kindergarten movement, was born in Glarus, Switzerland, and schooled in Pestalozzian methods. He came to Louisville, Ky., in 1852. As director of the German-American Academy there, he established a kindergarten in 1865. Influenced by the principles of Pestalozzi and Froebel, he and his wife spent their lives founding kindergartens and training teachers. He was active in the National Education Association and organized the Kindergarten-Primary Council of the West.

**HAILSHAM**, market town, England, in Sussex, seven miles N of Eastborne and 54 miles SE of London. It has a Perpendicular church and an Early English Augustinian priory. Its cattle and sheep market is one of the largest of England. Rope, brushes, and mats are manufactured. Pop. (1950, est.) 37,100.

**HAINAN**, a large island of SE China, lying 15 miles S of the Luichow Peninsula of Kwangtung Province, from which it is separated by the Hainan Strait. Hainan is 160 miles long by about 100 miles wide, and lies between the Gulf of Tonkin and the China Sea, with French Indochina to the west; area 13,500 sq. mi.; pop. (1936 est.) 3,000,000. Hainan's coastlands are flat, but its inland sections rise to densely forested peaks of 6,000 to 7,000 feet altitude. The island is subject to frequent earthquakes, and, in summer, typhoons. In the fertile valley sections, rice, tobacco, fruits, and betel nuts are grown, and ducks, chickens, and pigs are raised for Chinese markets. Cattle and hides are exported. Minerals found here include tin, gold, silver, copper, lead, and iron. Marble, granite, and sandstone are quarried. The chief towns are KIUNGSHAN (pop. 70,000), the capital; HOIHOW, the principal port; and Mencheong, Kachek, Nodoa, Linkao, Tanhsien, Sunshingshi, and Manning.

The island was conquered by the Chinese in 100 B.C. In 1858, by the Treaty of Tientsin, the port Hoihow was opened to foreign trade. Hainan was invaded in February, 1939, by the Japanese. The Chinese recovered possession of the island in October, 1945. The Chinese National Government, driven from the mainland in 1949, yielded Hainan to Communist forces in May, 1950.

K. E. H.

**HAINAUT**, province of SW Belgium, lying alongside of the French department of Nord; area 1,436 sq. mi.; pop. (1949 est.) 1,247,299, principally Walloons.

Hainaut is generally level, broken by spurs of the Ardennes; its principal rivers are the Haine, Scheldt, Dender, and Sambre. Large crops of flax, wheat, fruits, vegetables, and sugar beets are produced; horses, cattle, and sheep are raised. Toward the south and southeast near Mons and Charleroi are large coal fields known as the Borinage. Iron is also mined, and marble and limestone are quarried. The principal manufactures include linen, laces, iron and steel products, porcelain, paper, and leather goods. The capital is MONS; the chief industrial towns are CHARLEROI and TOURNAI.

From the 9th to the 17th centuries Hainaut formed an independent countship; from 1678 it was divided between France and the dynastic rules of Spain and Austria. During World War I it was the scene of much desperate fighting around Mons and Charleroi, which were captured by the Germans in August, 1914. During World War II Mons and Charleroi, were again the locality of fierce fighting, the American First Army succeeding in trapping and taking prisoner between the two cities the greater part of three German divisions, in the latter days of August, 1944.

K. E. H.

**HAINES**, village, Alaska, on Chilkat Peninsula, on the W side of Chilkoot Inlet, and the Alaska Coastal Airlines. The population, largely native, is engaged in fishing and fur farming. The settlement is an outlet for the Porcupine mining district. Haines Mission, an orphanage for Indian children, is located here. Pop. (1950) 336.

**HAINES CITY**, city, central Florida, in Polk County, on the Atlantic Coast Line Railroad and U.S. highways 17 and 92, about 20 miles NE of Lakeland, surrounded by hills blanketed with orange and grapefruit groves. Formerly called Clay Cut, the city was renamed to honor Henry Haines, railroad promoter, who reciprocated by making the settlement a railroad station; it was incorporated in 1920. Citrus fruit canning and packing plants and feed mills are the chief industries. Pop. (1950) 5,630.

**HAIPHONG**, seaport, French Indochina, Viet Nam Republic, in North Viet Nam, on a branch of the Red River, 20 miles inland from the Gulf of Tonkin; and 60 miles by rail E of Hanoi. There are manufactures of rice, weaving, cement, and near by at Hongay there are coal mines. Haiphong has ship-building yards and a French naval station in its harbor. The town was held by the Japanese during World War II, and severe fighting broke out in late 1946 in the Chinese quarter when French troops attempted to take over customs control from Viet Nam officials. Pop. (1946 est.) 74,000.

**HAIR**, the characteristic covering of mammals, never completely absent in normal mammals. Its primary function is to maintain the body temperature by diminishing the loss of heat; but in many mammals certain hairs act also as sense organs, constituting the *vibrissae*, or whiskers.

Histologically, hairs are outgrowths of the epidermis, and develop in little pits known as the *hair follicles*. These lie in the corium or true skin, or may even penetrate into the subcutaneous tissue. Epidermis forms the inner layer of the follicle, and as it surrounds the base or root of the hair very closely, it is often pulled out with the hair, and is consequently known as the root sheath. The corium rises up at the base of the follicle as a vascular papilla; this is the important structure as regards the growth of the hair, and in fixing it in position, for the hollow base of the root fits over this projecting papilla like a cap.

The hair itself may be divided into the body, or shaft, and the root. The shaft has externally a cuticle of overlapping scales; beneath this is a pigmented fibrous layer; while the center in some cases is occupied by a dark colored medulla, composed of angular cells, between which air bubbles may occur. The root is similar in structure, but is enlarged, and consists chiefly of young growing cells. It is the papilla which

supplies the material which is necessary for the growth of the hair.

Each hair follicle has attached to it a little bundle of muscular fibers, by means of which the hair may be erected. These muscles are of the nonstriated type, and cannot be made to contract voluntarily; but they do so under the influence of certain emotions—e.g., fear.

The coloring of the hair is due primarily to the nature and amount of the pigment present in the fibrous layer. When minute air bubbles appear in this layer, the hair is white. The color of the hair is affected also by the color of the medulla, when present; for it may also contain air bubbles, whose presence in this instance imparts a dark color. The duration of hair life is limited, and sooner or later it is shed. As age advances the hair becomes gray. This is a natural and physiological process; but it may be hastened by severe trouble or other causes. In many cases the premature blanching of the hair is hereditary.

The hair is regarded by anthropologists as of high importance as a race character. Although there is no one special color of hair peculiar to any one race, there are characters present in the hair which separate many of the races of man widely from one another. In the American Indians, Chinese, Japanese, and natives of various other parts of Asia the hair is long, straight, and harsh like a horse's mane. Among the Negroes, Hottentots, and Papuans it is crisp and woolly. Between these extremes we may place the European, in whom the hair is wavy and flowing.

**HAIR GRASS** is a genus of perennial grasses of agricultural value. They are characterized by a lax panicle, the spikelets being laterally compressed, with two perfect florets.

**HAIR INDUSTRIES.** The U.S. Bureau of the Census defines the hair industry as including all industrial plants that clean, bleach, dye and curl hair. The industry utilizes human hair and hair obtained from such animals as the horse, camel, Angora goat (furnishing the product known as mohair), yak, rabbit, pig, cow, and steer.

The processing and making over of human hair is an established industry, the major portion of which is devoted to the manufacture of wigs, toupees, etc. Theatrical wigs, beards, and other make-up requiring hair often consist of yak and goat hair. Most of the hair worked into felt goods, such as blankets, hats, low-priced overcoats and jackets, is that of the cow and steer. Rabbits and goats also furnish quantities of hair for this type of use. Cow hair is used as a binding agent in wall plaster and in roofing materials. This hair is obtained from tanneries where cattle hides are processed. Tail hair from cattle, which is very long, is much used in upholstery work, after it has been properly processed and curled. The stiff bristles of the pig are used for tooth and clothes brushes and for abrasive-type brushes. The curling, molding, and dipping of hog hair in rubber to form cushioned upholstery material is a new process that makes the material both vermin and waterproof. Haircloth, made of woven horsehair, is utilized as a stiffening agent in garment lapels, collars, etc. Braided horsehair is used in fishing lines. Paintbrushes of long, soft horsehair are much in demand and are costly.

**HAIRDRESSING**, the arrangement of the hair into styles that are now dictated by fashion, but in ancient times were indicative of age or rank. Spartans forced the young boys to crop their locks short and only allowed full-grown men to wear long hair. In the Celtic tribes of Britain long hair symbolized esteem and eminence. Short hair meant servitude or that the wearer was doing penance for a disgrace or a breach of law. Religion has also played an important part in hairdressing. The Moslems shaved their heads, leaving only a small tuft by which to be ultimately lifted into Paradise. The love locks worn by the courtiers and cavaliers of 17th century Europe excited the ire of the Puritans, who wore their hair severely straight.

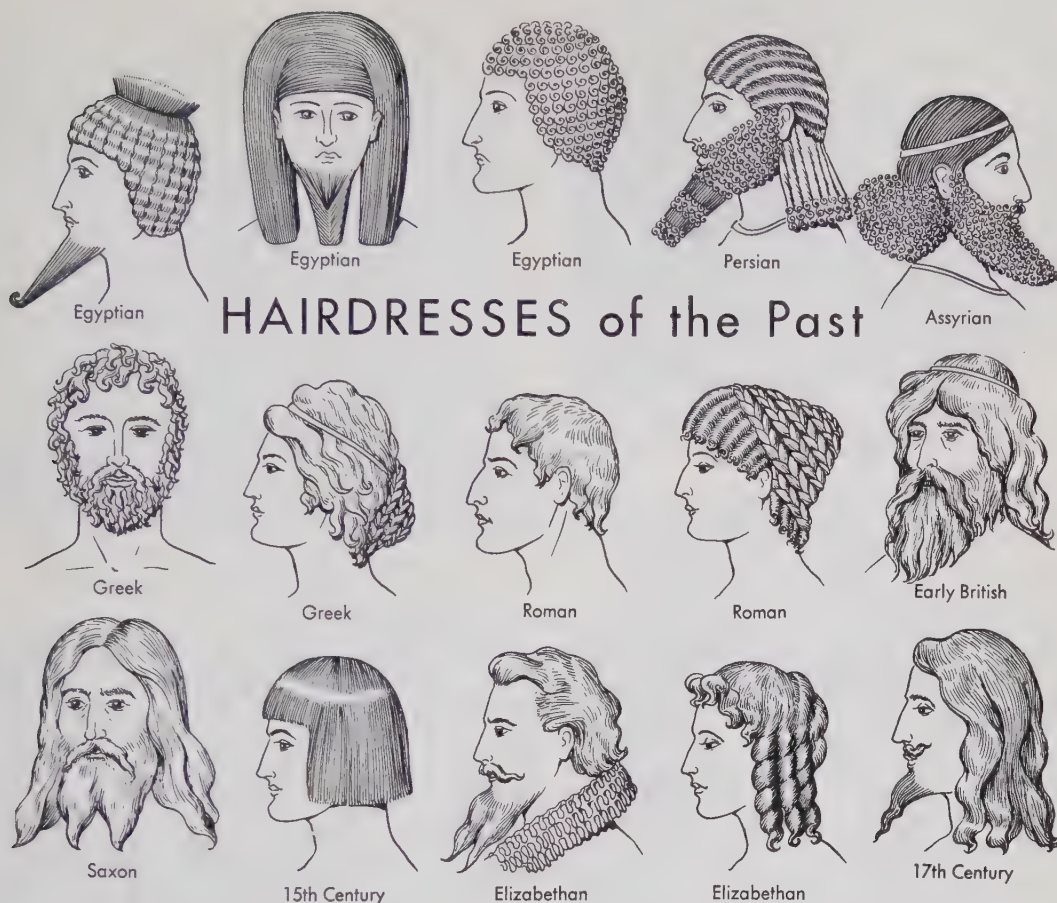
**Coiffures of the Ancient World.** Fashion, however, has always been the prime reason behind hair styling. The earliest records date from Egypt, where the hair was usually either gathered into many braids with frizzled ends or curled in hundreds of hanging, ropelike rolls. Beads, jewels, and ribbons were often intertwined and false beards for men as well as wigs were common. Hairdressing was done by the slaves. Greeks and Romans wore curled but simple hair styles. One fashion consisted of a ribbon bound round the head, the hair being gathered up in a loose knot at the back of the neck. In another more elaborate style the hair was cut, curled all over, confined by bands on the forehead, and gathered up at the back of the head by a ribbon, from which it fell in loose curls. Greek and Roman men had short hair and square beards or shaven faces. Roman women curled their hair in ringlets around the forehead. The diadem was much favored by Greeks and Romans.

**Elaborate Styles.** Early styles in northern Europe called for hair hanging loose or braided, until the Romans introduced the custom of wearing short hair. During the Middle Ages elaborate headdresses appeared that completely hid the hair. Any hair that showed beneath the headdress was plucked; even eyebrows and eyelashes were removed. About 1550 hair began to emerge from under the headdress and was done in a pompadour or in rolls, with the headdress utilized as part of the hair style. By the late 18th century hairdressing had so increased in ornamentation that hair was sometimes built up to a height of three feet, with ribbons, jewels, feathers, flowers, and even models of castles and ships arranged in it. The coiffures were often so difficult to set that the women spent the day before an important event with their hairdressers and were forced to sit up all night so as not to disturb the curls. Usually the hair was not combed for two to nine weeks afterwards.

**Shorter Styles for Men and Women.** After the French Revolution, comparative simplicity reigned. Powder came into fashion and the hair was arranged closer to the head. Styles continued to be relatively plain until the late 19th century, but the early 20th century saw the revival of the pompadour. Men's hair styles also went through a change at this time. In 1830 men shaved their chins and wore short side whiskers; these gradually became longer, until a climax was reached with the Dundreary whisker. At the turn of the century a reaction set in favor of total shaving or the wearing of beards. Recent styles for men include the close-cropped crew cut and the more conventional short style combined with either clean shaving or compact mustache. Women continued to wear their hair long until after World War I when bobbed or spingled hair came into fashion. The 1920's favored flat waves shaped with sharp ridges, but the end of the 1930's again saw the return of the pompadour and the inception of long straight hair curled under only at the ends, called the page boy style. The chignon and the simple Grecian hairstyle parted in the middle and tied in a soft knot in the back began a slow revival in the 1940's, together with the medieval bang.

**Wigs.** Wigs and partial hairpieces were used in all ages, being most popular when styles required more hair than normally grew on the head. In Rome baldness was considered a deformity and bald men wore wigs or toupees. The long braids of medieval women were attained by the addition of artificial hair. In all periods women wore hairpieces to achieve elaborately curled pompadours or curls to adorn the top or sides of the head, and switches to augment hair. When fashion decreed that the hair must stand away from the face, it was padded out by the use of rolls of wool or human hair and wire or stiff cloth frames. These artifices were extensively used from the second half of the 16th century to the middle of the 18th. The 1930's saw the revival of the rat or hair pad to increase the height of pompadours.





## HAIRDRESSES of the Past

**Curling Methods.** Devices to make hair curl have existed since prehistoric times. Curling irons are very old, but even more ancient is the method of winding wet hair around twigs and sometimes heating it. This technique of achieving curls later developed into the kid and tin curlers used in the 20th century. The 20th century saw the invention of the permanent wave, a curling method that results in waves lasting from three months to a year, and the marcel in which a hot curling iron makes metallic-looking waves which last for a week or more. Popular during the 1920's, the marcel soon afterward passed out of style.

**Coloring.** Hair color has had cycles of popularity. In medieval days blond or black hair was favored and red very much disliked. Bleaching and dying were common. Venetian women used a mixture of black sulfur, alum, and honey on the hair, spread the locks out on the brim of a crownless hat and sat in the sun until their hair was the desired golden hue. Wigs were of varied colors. Egyptians favored black, but also used red, green, or blue. About 1690 wigs were powdered with gray or tan; by 1704 white was most stylish. Frequently the natural hair color of a king, queen, or a king's mistress would set the style for a period. Queen Elizabeth's red locks which began a fashion for hennaed hair in 16th century England are an outstanding example.

**Hairdressers.** Elaborate hair styles required someone to attend to them. In early times trained slaves were responsible. Then men or maid servants were given the job. Around the 1700's barbers began to do men's hair, and in 1735 the first women's hairdresser, a man, became prominent in the French court. Until the 20th century all women had their hair done in their homes, either by their maids or by hairdressers who came to the house for that purpose. It was not

until after World War I, when women of all classes had their hair dressed, that the modern beauty shop began. See HEADDRESS; WIG. DAHY B. BARNETT

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**HAIRSTREAK**, usually brownish, delicately striped BUTTERFLIES belonging to the family *Lycaenidae*. The male often has a small oval spot on its forewings and a short tufted hairlike beard which is thin or almost wanting in the female. The banded hairstreak, *Thecla calanus*, is found throughout the northeastern United States, while the white-m hairstreak, *T. m-album*, is predominant in the south. The larvae vary in feeding habits.

**HAIRWORM**, belonging to the class *Nematomorpha*, is found in fresh-water ponds and ditches. The genus *Gordius* is best known. The common name may be ascribed to the erroneous belief that the worms arise from horsehairs dropped into the water.

The life cycle is somewhat obscure. Eggs are laid in long strings around water plants. Shortly spiny-headed larvae emerge and bore into the bodies of aquatic insect larvae. Hairworms are next found in land insects such as beetles. How the larvae reach the second host is not well understood, but it is reasonable to suppose that the infested aquatic insect larvae mature and leave the water. On land the infested insect may die, but the hairworm larva escapes to infest some land insect. If the infested insect is eaten by another insect, the hairworm larva then infests that insect. The larva undergoes further development within the second host, leaves the host, and falls into the water where it finally matures. Adult hairworms may range from a few inches to several feet in length and vary in color from brown to black.



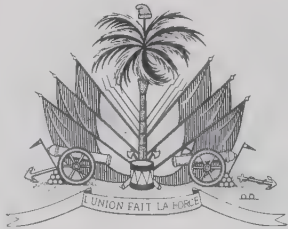
K.L.M. ROYAL DUTCH AIRLINES

*Negro republic, set up by the rebel slave  
Toussaint l'Ouverture; here voodoo drums  
still beat in today's civilization*

**HAITI**, a republic of the West Indies, occupying the W part of the island of Hispaniola, which it shares with the Dominican Republic; area 10,714 sq. mi.; pop. (1950) 3,097,220. The island, which is one of the Greater Antilles, lies between Cuba and Puerto Rico. The republic of Haiti consists principally of two peninsulas extending west into the Caribbean, washed by the Atlantic Ocean on the north and separated from Cuba by the Windward Passage.

Much of the country is mountainous with three principal ranges reaching the altitudes of 8,790 feet. Between the ranges are plateaus and fertile valleys, some areas of which are irrigated, in which most of the people live. The Artibonite is the principal river, and the Saumâtre is the largest lake. Haiti has a warm climate along the coast, but the mountain areas are cool. Seasonal rains come between April and June and in October and November.

**People.** Haiti, one of the two Negro republics of the world, is one of the most densely populated countries of the Western Hemisphere. About 90 per cent of the people are Negroes; the remainder are mulattoes, descendants of early French settlers. At least 95 per cent of the people have very small incomes and low standards of living. The official language of the country is French, although most of the people speak a French patois known as Creole.



Haitian coat of arms

| PRINCIPAL CITIES    | POPULATION<br>1946 est. | POPULATION<br>1950 census |
|---------------------|-------------------------|---------------------------|
| Port-au-Prince..... | 125,000                 | 134,117                   |
| Cap-Haïtien.....    | 20,000                  | 24,423                    |
| Gonaïves.....       | 13,000                  | 13,634                    |
| Les Cayes.....      | 12,000                  | 11,608                    |
| Port-de-Paix.....   | 10,000                  | 6,405                     |

Although education in the cities is modeled after the French system, the study of English was made compulsory in all schools in 1942. Primary education is free and compulsory between the ages of 7 and 14. There are also secondary schools and special schools for law, engineering, medicine, and agriculture. Illiteracy is estimated at 90 per cent. Roman Catholicism is the official religion but folk creeds, such as voodooism, are widely followed.

**Economic Life.** The prosperity of Haiti is dependent upon agriculture, carried on by small landowners. Extensive irrigation has increased the amount of tillable land. Coffee, Haiti's chief product, ac-

## Haiti

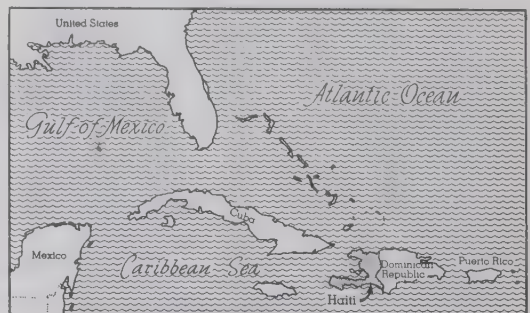
counted for 58 per cent of the exports during 1920-1950. In 1953-54 coffee accounted for 78 per cent of the value of all exports. Other exports are sisal, bananas, sugar, cotton, cacao, castorseed, goatskins, essential oils, and mahogany articles. The United States takes about 45 per cent of the exports and supplies about 60 per cent of the imports. Manufactures include vegetable oil, lard, rum, cigarettes, leather, shoes, brick, and wood products. Haiti has large undeveloped mineral resources, including gold, silver, copper, iron, and tin.

Haiti has the services of several steamship lines. There are about 1,800 miles of highways in the republic, and about 160 miles of railroad in two lines, both owned by United States capital. Haiti has regular airline service.

**Government.** In 1950 a revolutionary junta abrogated the 1946 constitution and drafted a new constitution. For the first time provision was made for the direct popular election of the president, who is ineligible for immediate re-election after serving a six-year term. The National Assembly consists of 21 senators elected for six years and 37 deputies elected for four years; these legislators are all elected by the primary assemblies of the departments. The General Assembly has the power to amend the constitution. The republic is highly centralized on the French model with five departments, which are divided into arrondissements and communes.

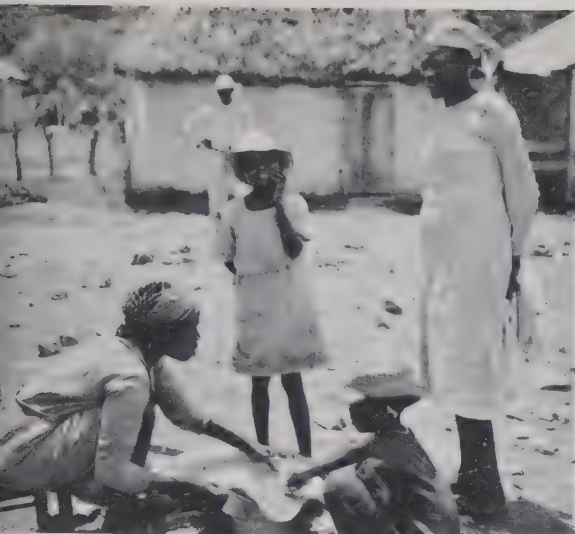
**History.** The island of Hispaniola was discovered by Columbus on Dec. 6, 1492; and in little more than a generation the aborigines were swept away by the cruelties of the Spaniards, who as early as 1505 introduced Negro slaves to fill their places. Next came the buccaneers; and as those marauders were chiefly French, the western portion of the island, which was their favorite haunt, was in 1697 ceded to France by the Peace of Ryswick. Napoleon's attempt to re-enslave the Negroes, who had been freed in 1794, resulted in a series of massacres, and ended in the expulsion of the French and British by TOUSSAINT L'OUVERTURE in 1798. In 1804 DESSALINES, following the example of Napoleon, proclaimed himself emperor of Haiti; in 1811 Christophe was proclaimed king; and in 1844 the eastern Negroes separated from Haiti, and formed the Republic of Santo Domingo (now the DOMINICAN REPUBLIC).

The history of Haiti is marked by frequent revolutions, the more recent ones being in 1908, which resulted in the deposition of President Alexis, and the succession of General Simon; another in 1914, when President Zamor was defeated by Davilmar Theodore; and another in February, 1915, when President Theodore was forced out by a revolution led by General Guillaume. Revolutions and massacres again in April and July brought American marines to restore order, and at last in November, 1915, the United States established a virtual protectorate over Haiti by a treaty ratified by the Haitian National assembly. In addition to establishing law, order, and the security of life and property, the United States forced improved sanitation, built roads, installed sew-



Location map of Haiti





**Haitian Native Types** in Dondon village; about 90 per cent of the country's population is Negro

EWING GALLOWAY



**Cabana Chouconne**, a hotel near the small formal park in Petionville, is built like an oversized hut

K.L.M. ROYAL DUTCH AIRLINES

**Public Market** at Archahaie on the west coast is typical of the trading centers of all Haitian towns

EWING GALLOWAY



EWING GALLOWAY

**Old Pier** in the harbor at Port-au-Prince provides docking space for Haitian shipping of many classes



K.L.M. ROYAL DUTCH AIRLINES

**Port-au-Prince**, seaport situated on the Gulf of Gonaives, is the capital and largest city of Haiti



GRACE LINE

**Sans Souci palace** in the mountain foothills near Cap-Haitien was built by King Henri Christophe





EWING GALLOWAY

**Banana Trees** on large plantation are sprayed near Gonaïves. The fruit is one of Haiti's chief exports



K.L.M. ROYAL DUTCH AIRLINES

**Jean Jacques Dessalines**, liberator of Haiti, is honored by this monument at Port-au-Prince airport

erage plants, and built hospitals. In 1918 Haiti joined the Allies against Germany.

American control of Haiti involved a delicate situation, arousing suspicion in the island, among the Latin Republics, and even protest in political circles at Washington. Haitians and most of their leaders regarded the occupation with discontent, leading to numerous revolts, promptly suppressed by American Marines. In 15 years the adventure cost the United States over \$23,000,000. In February, 1930, President Hoover appointed a commission to investigate the problem, before which body strong protests were made by the Haitians against the occupation. American troops were finally withdrawn in 1934. The treaty of 1915, by which the Haiti government accepted American advisers, terminated in 1936, but by a new agreement the president of the republic agreed to appoint an American fiscal representative on the recommendation of the president of the United States. In 1941, when President Élie Lescot was inaugurated, this representative resigned and the arrangement was ended with the acquiescence of the United States.

Haiti declared war against the axis powers in December 1941, immediately after the United States entered World War II. In April 1944 the National Assembly revised the constitution and extended the term of President Lescot to 1951. Lescot was overthrown, however, by a military junta in January 1946; Dumarsais Estimé was then elected president by the National Assembly and a new constitution was adopted. In 1947 Haiti participated in the Inter-American Defense Conference at Rio de Janeiro and signed the Treaty of Reciprocal Assistance. During 1949 the government had to take strong action to maintain itself in power, and at the same time there were strained relations with the Dominican Republic. President Estimé was forced to resign in 1950 by a military uprising led by Col. Paul Magliore. A new constitution was drafted and Magliore was elected president in a direct popular election. In October 1954 a hurricane killed more than 400 persons, left more than 250,000 homeless, and inflicted widespread destruction on the island's crops, especially coffee. In 1955 President Magliore visited the United States and made a successful appeal for economic aid for his country. Funds were also secured for "Haiti's Little TVA" in the Artibonite Valley. A severe drought in 1955 intensified the country's need.

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**HAKATA.** See FUKUOKA.

**HAKE**, a genus of fishes closely related to the cod family *Gadidae*, having a flattened head, and elongated body, covered with bright scales, two dorsal fins, of which the first is short and the second very long, one long anal fin, and the mouth destitute of barbels. The species abound in all temperate and moderately cold waters. The common English hake is *Merluccius vulgaris*, and the American is *M. bilinearis*. The American fish has larger scales than the European species. The hake is sometimes 3 or 4 feet in length, weighs about 5 pounds, and is of a whitish color, grayish on the back. It is voracious, devouring great numbers of herrings and pilchards; hence it is frequently called the herring hake. Its habits are similar to those of the cod; it is found in the same localities, and caught in the same way. The flesh, white and flaky, is salted and dried in the same manner as cod and ling.

**HAKLUYT, RICHARD**, c. 1552–1616, English geographer, was educated at Oxford. He was interested in the history of discovery and, having been appointed to lecture at Oxford, was the first to introduce maps, globes, spheres, etc. in common schools. In 1582 he published his *Divers Voyages Touching the Discovery of America*. In 1583 he went to Paris and collected much information regarding French and Spanish voyages, and published a translation of the journal of the French explorer Laudonnière, under the title *A Notable History Containing Four Voyages made by Certain French Captains into Florida* (1587). Besides the works mentioned, he published *Principall Navigations, Voiages, and Discoveries of the English Nation* (1589). The Hakluyt Society, named in his honor, was established in London in 1846 for the purpose of printing unpublished voyages and travels.

**HAKODATE**, seaport, Japan, on the SW peninsula of Hokkaido Island. It is the chief port and second largest city of Hokkaido and the northern terminus of a ferry service with Aomori, Honshu. It has manufactures of cement, hemp, fish nets, and fish products; exports peas, pulse, beans, marine products, sulfur, furs, and timber; and imports salted fish, kerosene, and oil cake. For centuries Hakodate was a refuge of the aboriginal Ainu, driven from Honshu by the advancing Japanese. In the 16th century the Matsumae daimyo (feudal barons) established their headquarters here, and they held southern Hokkaido as a fief from the Tokugawa Shoguns until 1868. Hakodate (1859) became one of the three first ports in Japan opened in modern times to foreign trade, Tokugawa adherents made a last stand against the imperial restoration at Hakodate in 1869; following their surrender, the imperial government reorganized the government of Hokkaido. In the 1870's Hakodate developed as a frontier town, rather Western (United States) in appearance under the influence of American geologists, agricultural experts, and engineers who were brought to develop the island. It was the summer port for the China Squadron of the British navy for a



time, and the Russians once used the harbor as winter port. The Bay of Hakodate, an inlet of Tsugaru Strait, separating Honshu and Hokkaido, is completely landlocked and provides a spacious harbor. Pop. (1947) 211,441. C. S.

**HALAKHA.** See TALMUD.

**HALAZONE**, a white powder having a pronounced chlorine odor, used particularly to disinfect water for drinking purposes. Chemically halazone is the paradichlorosulfonamide of benzoic acid.

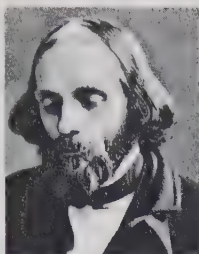
**HALBERSTADT**, town, Germany, in the Prussian province of Saxony, on the Holzemme River, at the foot of the Harz Mountains; 30 miles by rail SW of Magdeburg. Many of the houses in the town have wood carving in variegated colors, dating from the 15th and 16th centuries. Near by is Klusberge with its prehistoric cave dwellings. The chief industries of Halberstadt include railway repair works and manufactures of sugar, paper, cigars, leather goods, sausages, and beer. The town was frequently bombed in World War II and taken by the Americans on Apr. 11, 1945. It was later incorporated into the Soviet occupation zone. Pop. (1946) 57,187.

**HALDANE, JOHN BURDON SANDERSON**, 1892–, English scientist, was educated at Eton and New College, Oxford. During World War I he served with the Black Watch in France and Iraq. He started his scientific career in 1922 as reader in biochemistry at Cambridge University. In 1930 he was made Fullerian professor of physiology at the Royal Institution and in 1933 professor of genetics at London University. After 1937 he was professor of biometry at University College, London. He became well known for his clear exposition of scientific matters for the layman in such books as *Possible Worlds* (1927); *Science and Ethics* (1928), *Enzymes* (1930); *The Inequality of Man* (1932); *The Causes of Evolution* (1933). His later works reflected a Marxist viewpoint: *Heredity and Politics* (1938); *The Marxist Philosophy and the Sciences* (1938); *Science in Peace and War* (1940); *New Paths in Genetics* (1941); *A Banned Broadcast* (1947); *Science Advances* (1947).

**HALDEN**, until 1928 **Fredrikshald**, lumber center and seaport, SE Norway, in Østfold County, at the mouth of the Tistedal River, on the Skagerrak, 60 miles SE of Oslo, near the Swedish border. There are lumber and pulp-paper mills, marble and granite quarries, and manufactures of machines, matches, butter, boots, shoes, paper, and textiles. In Norse times the town was a settlement known as Halden, becoming Fredrikshald in 1661. It was the scene of many battles among the Scandinavian countries. Under its walls Charles XII of Sweden was killed in 1718. Halden was occupied by the Germans in 1940 and liberated in May, 1945. Pop. (1946) 9,368.

**HALDIMAND, Sir FREDERICK**, 1718–91, British soldier and administrator, was born in the Canton of Neuchâtel, Switzerland. After being a mercenary soldier, he joined the British army in 1756 and saw service during the French and Indian War in the attack on Ticonderoga (1758) and in the defense of Oswego (1759). He accompanied Amherst's expedition against Montreal (1760) and on the fall of Canada to the British remained in command at Three Rivers, Quebec, until 1766. When the Spanish surrendered Florida he was transferred to the fort at Pensacola. His career reached its zenith during 1778–84 when he was governor and commander in chief in Canada, with the rank of lieutenant general. He played an important part in keeping the Quebec French loyal to Britain during the closing years of the Revolution and provided well for the Loyalists who began to arrive in great numbers after 1783.

**HALE, EDWARD EVERETT**, 1822–1909, American author and clergyman, was born in Boston and was educated at Harvard University. He was ordained as a Unitarian minister and occupied several pulpits before he was appointed chaplain of the U.S.



CHICAGO HIST. SOC.

Edward E. Hale

Senate, a post he held from 1903 until his death. He was a prolific and versatile writer, his creative span extending from *My Double, and How He Undid Me* (1859) to *Foundations of the Republic* (1906). His most popular and enduring work proved to be "The Man Without a Country," a short story published first in the *Atlantic Monthly* in 1863, in which the main character, Philip Nolan, curses his country during his treason trial and

is sentenced to sail the seven seas, never to see or hear of his native land again. Hale also wrote a number of novels; two autobiographical volumes, *A New England Boyhood* (1893) and *Memories of a Hundred Years* (1902); *Franklin in France* (2 vols. 1887–88); and miscellaneous works.

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**HALE, GEORGE ELLERY**, 1868–1938, American astronomer, was born in Chicago. He was graduated from the Massachusetts Institute of Technology (1890) and studied at Harvard College Observatory and the University of Berlin. He served as director of the Kenwood Astrophysical Observatory, Chicago (1890–96); associate professor (1892–97) and professor (1897–1905) of astrophysics at the University of Chicago; organizer and director of the Yerkes Observatory (1895–1905); and director of the Carnegie Institution's Mount Wilson Observatory, Pasadena, Calif. (1904–23). His principal research was in the domain of solar and stellar spectroscopy, and he became widely known as the inventor of the SPECTROHELIOGRAPH. One of his best known discoveries is that of magnetic fields in sunspots and the general magnetic field of the sun. He was joint editor of *Astronomy and Astrophysics* (1892–95) and founder of *The Astrophysical Journal*, which he edited (1895–1935). He wrote many papers on solar physics and among his books are: *The Study of Stellar Evolution* (1908); *Ten Years' Work of a Mountain Observatory* (1915); *The New Heavens* (1923); *The Depths of the Universe* (1924); *Beyond the Milky Way* (1926); *Signal from the Stars* (1931).

**HALE, NATHAN**, 1755–76, American Revolutionary soldier, was born in Coventry, Conn. He was graduated from Yale in 1773, and taught school at East Haddam and New London, Conn., until after the outbreak of the American Revolution. He en-



JOSEPH BOGGS BEALE-MODERN GALLERIES

Execution of Nathan Hale, 1776

tered the Continental Army in July, 1775, and became a captain in January, 1776. In September, 1776, he volunteered to enter the British lines at New York to procure information for General Washington. Disguising himself as a Dutch schoolmaster, he made his way to Norwalk, Conn., then crossed to Long Island, where he was detected, tried, and condemned, and executed as a spy (Sept. 22, 1776), his last words being, "I only regret that I have but one life to lose for my country." His youth, his character, and the courage with which he met death have made him a popular hero in America. There is a statue of Hale by Gerhardt in Hartford, Conn., and one by MacMonnies in City Hall Park, New York City.

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**HALE, NATHAN**, 1784–1863, American journalist, nephew of NATHAN HALE, the patriot, and father of EDWARD EVERETT HALE, was born in Brookline, Mass. He was educated at Williams, and was admitted to the bar in 1810. As editor of the *Boston Daily Advertiser* (1814–54) he established a tradition of editorial responsibility which was the basis of public confidence in the press in general. The *Advertiser* was the first American newspaper which regularly published unsigned editorials. Hale was also a founder of the *North American Review* (1815) and the *Christian Examiner* (1823), and published and edited the *Monthly Chronicle* (1840–46).

**HALE, SARAH JOSEPHA**, 1790–1879, American author and editor, born in Newport, N.H. She became editor of *The Ladies' Magazine* in 1828, and after its amalgamation in 1837 with *Godey's Lady's Book*, continued as editor of the latter. Her celebrated nursery rhyme "Mary Had a Little Lamb" first appeared in the *Juvenile Miscellany* (September, 1830) and was included in her *Poems for Our Children* (1830). Among her other works are *Northwood* (1827), an antislavery novel; *Sketches of American Character* (1833); *Traits of American Life* (1835); *Women's Record* (1853), lives of great women. She was instrumental in establishing THANKSGIVING DAY.

**HALE, WILLIAM GARDNER**, 1849–1928, American classical scholar, was born in Savannah, Ga., and graduated from Harvard University (1870), and studied at the universities of Leipzig and Göttingen. He was professor of Latin at Cornell from 1880 to 1892, when he became head of the Latin department at the University of Chicago. He was one of the founders and the first director of the American School of Classical Studies at Rome. His *Art of Reading Latin* (1887) illustrates his realistic approach to the problem of teaching Latin. In 1895 he discovered a new Catullus manuscript in the Vatican Library, and following his retirement his research was largely devoted to textual criticism.

**HALEDON**, borough, NE New Jersey, in Passaic County. The borough is a residential suburb of Paterson. Pop.(1950) 6,204.

**HALES, ALEXANDER OF**. See ALEXANDER OF HALES.

**HALES, STEPHEN**, 1677–1761, English scientist, inventor, and clergyman, was born in Bekesbourne, Kent, and studied at Corpus Christi College, Cambridge. After taking orders in the Church of England he became perpetual curate of Teddington (1708). His principal botanical publication was *Vegetable Sta-*

*ticks* (1727), in which he described his experiments on plant nutrition, and especially the flow of sap in trees, and thus revived the science of plant physiology. In the field of animal physiology he devised a pressure gauge which enabled him to be the first to determine blood pressure. He invented an instrument which showed the movements of the heavenly bodies, and a windmill ventilator (1741). The Royal Society awarded him its Copley medal (1739) for his communication on methods of preserving water and meat during long sea voyages. His name was perpetuated in the Halesia, a genus of trees of the *Storax* family found in Georgia by the early colonists.

**HALEVY**, surname assumed by Jacques François Fromental Élie Levi, 1799–1862, French composer of Jewish parentage, was born in Paris. After studying at the Paris Conservatoire, he won the Grand Prix de Rome with *Herminie*, a cantata. In 1835 his greatest opera, *La juive*, was given its successful premier. Many popular operas followed of which *L'eclair* was the most notable. Today, though *La juive* is occasionally revived, it is the tenor aria "O Paradiso" which is most often heard.

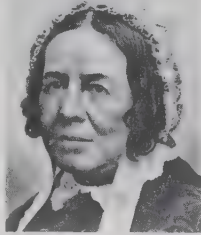
**HALEVY, LUDOVIC**, 1834–1908, French dramatist and librettist, was born in Paris. In 1864 he began collaborating with Henri Meilhac on a long series of *opéras bouffes*, or comic operas, which established the operetta as a popular dramatic genre. Their best known works were *La belle Hélène* (1865), *La vie parisienne* (1866), *The Grand Duchess of Gerolstein* (1867), and *La Périhole* (1868)—all with music by Offenbach—and *Carmen* (1875), with music by Bizet. They also wrote some sparkling comedies, as *St. Martin's Summer* (1873), *The Little Marquise* (1874), and *Froufrou* (1869), and Halévy, independently, published a number of successful novels, notably *The Abbé Constantin* (1882), a genial character study.

**HALF BREEDS AND STALWARTS**, terms applied to the liberal and conservative wings of the Republican party during the administration of Hayes. The "Half breeds" supported Hayes' liberal policy in removing troops from the South and they favored civil service reform. The "Stalwarts," led by Senator ROSCOE CONKLING of New York, tried unsuccessfully to bring about a third-term presidential nomination for Grant in 1880; Chester A. Arthur, one of their number, did secure the nomination for vice-president, and after the death of Garfield succeeded to the presidency. This factional division in the Republican party disappeared soon after Conkling retired from politics in 1881. See REPUBLICAN PARTY; HAYES, RUTHERFORD B.; UNITED STATES HISTORY.

**HALF LIFE**. See RADIOACTIVITY.

**HALF-TIMBER**, a method of building construction in which the structural beams are exposed and the space between them filled in with flat, light-colored wall areas. The material of the filled in area varies and may be wattle and daub, lath, plaster, or brick. In the anarchic times of the late Roman period stone buildings were replaced by the more quickly constructed, and more easily defended, tall and narrow timber dwellings which were often half-timbered on the top floors. From 1400 completely half-timbered constructions began to supplant masonry in all town houses, for it was both less expensive and more flexible. In the development of half-timbering the area to be filled in became increasingly greater and the timber became more ornamental, being shaped and carved in decorative ways. The style was universal in northern Europe for almost 300 years, but began to decline during the 17th and 18th centuries. A return to the half-timbered house came during the Gothic Revival of the 19th century, but for the most part the timber sections were merely applied decorations and had no structural part in the building. Modern half-timbered dwellings are usually built with this faked construction.

**HALFA**, province, Anglo-Egyptian Sudan, bordered on the N by Egypt, on the E by Kassala, on the



CHICAGO HIST. SOC.  
Sarah Hale





METRO-GOLDWYN-MAYER

**Various Halftone Screens** are indicated by the figure in each picture. Enlargement at right shows the formation and variation in size of the dots; the smaller dots produce light tones; the larger dots, heavy or shadow tones. These various-sized dots, when mixed by the eye, produce a complete image with proper tones

S by Dongola, and on the W by Libya. The population is principally nomadic. The province is largely desert, parts of both the Nubian and the Libyan deserts lying within its borders. The greatest height (4,067 ft.) lies in the eastern portion. The Nile enters the province just east of the middle of its southern border and flows northward with an easterly inclination, into Egypt. The Nile's third cataract is near the southern border and the second cataract is near the northern. From WADI HALFA, the chief town and the capital on the Nile, a railway runs to Khartoum at the junction of the White and the Blue Nile. A highway from Cairo traverses the province, extending to Merowe, the capital of Dongola. A desert caravan route leads from Egypt to the Selima and Laqiya oases, and from the latter a road runs in a southeasterly direction to connect with the Cairo-Khartoum highway at the town of Dongola, on the Nile.

**HALFTONE PHOTOGRAPHY.** This form of photographic activity is more or less restricted to photomechanics, the branch of photography devoted to the production of printed illustrations. It enters into almost every phase of the graphic arts, but regardless of the manner in which it is employed, the basic principles of the process remain the same.

**Halftone Screens.** These are essential items in halftone photography. They are made by coating two sheets of high-quality glass with an etching ground or acid-resisting coating, after which a series of parallel lines are ruled through the coating, thereby laying bare the glass in the ruled lines. Ruling is done on specially designed machines. The ruled plates are then subjected to a solution of hydrofluoric acid, which slightly etches the ruled lines into the surface of the glass. After filling the etched lines with an opaque black pigment, the acid-resisting coating is removed. The two rulings (plates) are then cemented together with Canada balsam, the parallel lines of one crossing the lines of the other at right angles, the finished screen taking the form of a grating or arrangement of opaque lines and transparent squares.

To cope with the different requirements of photomechanics and printing, halftone screens are made in an array of rulings, ranging from 50 to 400 lines

per inch. The coarser rulings are employed for newspaper illustrations and printing on poor and rough-surfaced papers, whereas the finer rulings are used for good-quality illustrations and printing on high-quality enameled paper. Besides being furnished in different rulings, halftone screens are made in different shapes and sizes. Screens of rectangular shape are supplied in dimensions from 6 by 8 to 30 by 40 inches, while screens of circular shape are made in diameters from 13½ to 60 inches.

**Purpose of Screen.** The halftone screen is an optical instrument that translates the detail and tone values of an original or subject into an image consisting of a series of regularly spaced dots. The number of dots per square inch of image is governed by the ruling of the screen. The size of each dot is in exact relationship to the detail or tone represented in any minute point of the original to be reproduced. Light tones are represented by very small dots, whereas heavy or shadow tones are translated in the form of correspondingly large dots.

It is on this variation of dot size that the halftone process is based. Because a printing plate made from a halftone negative also bears a series of equally spaced individual dots or printing elements, it is possible to apply printing ink only to the dots themselves. When the ink is transferred to paper during the course of printing, there results an impression (reproduction) in the form of an ink image. The image consists of many thousands or even millions of separate dots, each of a specific size and shape for accurate portrayal of the original.

**Halftone Screen Theory.** Although the discovery of the halftone process cannot be credited to any one person, no uncertainty exists as to the introduction and theories of the halftone screen. Crossline screens as now used were first made in Philadelphia in 1885 by Frederic E. Ives, and manufacture of such screens was placed on a commercial basis in 1893 by Max Levy, also of Philadelphia.

Three main theories have been advanced to explain the action of the halftone screen in forming a dot image, but no one theory has gained general acceptance. The first or *pinhole theory* was announced in 1888

by Frederic E. Ives, who assumed the transparent apertures of the screen to act in the capacity of tiny (pinhole) lenses, each of which formed a vignetted or diffused image (dot) of the aperture or stop in the camera lens. The second or *diffraction theory* was enunciated in 1894 by Max Levy. This theory ascribed variation in dot size to the effect of light diffracted by the opaque lines of the halftone screen.

The theory which aroused the greatest interest was that propounded in 1895 by A. K. Tallent and A. W. Dolland, and investigated in the same year by the Canadian surveyor general, Étienne Deville. Known as *penumbral shadow*, the theory contends that the opaque lines of the halftone screen cast shadows on the photographic film or plate, the shadows becoming wider or narrower according to the intensity of the light reflected from any given point in the original copy.

The latest hypothesis was that proposed (1935) by Arthur Fruwirth and J. S. Mertle, and which combines the salient features of the Ives-Levy theories. The dot is assumed to result from the pinhole action of the screen apertures, the growth (size) of the dot being influenced during the camera exposure by the simultaneous effect of diffraction bands formed around the edges of the dot.

**Equipment.** In addition to screens, halftone photography requires special equipment, chiefly in the form of lenses, cameras, and powerful lamps for illuminating the original during reproduction. The lenses are of the *process* type, distinguished by relatively long focal lengths and possessing high resolving power (sharpness) as well as freedom from common optical errors—astigmatism, chromatic and spherical aberration, flare and distortion.

Cameras are of large and sturdy construction and are made in two general types—gallery and darkroom. The latter sometimes are of huge size and have the back end of the camera built into a wall of the darkroom, thereby dispensing with the portable plateholder required with the gallery type of apparatus. The most popular illumination for halftone photography is that from carbon arc lamps, though mercury-vapor tubes and high-wattage incandescent lamps also are employed.

**Negative Materials.** Halftone negatives were first made on wet collodion plates, but today special photographic films and dry plates are available for the purpose. These are known as *process materials*; they possess the extremely high contrast and resolving power necessary to obtain the sharply defined dot formations required in halftone images.

**Halftone Stops.** These are the apertures or diaphragms used in the camera lens during halftone exposures. The diameter (size) of the stop is in relationship to the scale of reproduction, and is governed by the camera extension or the distance from the lens stop to the photographic surface. Stops of circular shape give the best results, though odd-shaped apertures are employed for special effects.

**Screen Distance.** During exposure in the camera, a certain distance must exist between the surface of the halftone screen and the photographic film. This distance is necessary for proper dot formations in the negative and is controlled by the ruling of the screen. Coarse rulings require longer screen distance than do fine screens. With the Fruwirth-Mertle theory, screen distance ranges from one inch for a 50-line screen to 3/64 inch for a 200-line ruling.

**Halftone Exposures.** The exposure of a halftone negative is governed by a number of factors: the character of the original; the scale of reproduction; the screen ruling employed; the size of the lens stop; the power (actinic) of the camera lamps; and the sensitivity of the photographic film or plate.

Three main systems are used for exposure, these designated by the number of lens stops employed for the purpose. The 1-stop system uses a single aperture (in addition to a flash stop) and is the simplest pro-

cedure. It demands accurately sized stops and does not afford much latitude for controlling or altering the contrast of the halftone negative. The 2-stop system is perhaps most popular. It is based on giving a short supplementary exposure with a fairly large aperture (*high-light stop*), followed by a longer exposure with a smaller aperture (*detail stop*) to record the detail and gradation of the original.

The system affording widest control and giving best results with all types of originals is that employing three different sized apertures (3-stop). It utilizes progressively smaller apertures for the three phases of the exposure: the largest is the *high-light stop*, followed by a slightly smaller stop for the *middle tones*, and a still smaller aperture for the *detail exposure*. Control of contrast can be effected by changing the exposure time given with any one of the three stops.

**Flash Exposure.** This really is a separate phase of halftone exposure. It is made with a rather small stop and is in effect a form of "optical intensification" because it increases the opacity of the dot formation, likewise introducing a series of very small dots in the darkest (shadow) areas of the halftone negative. The flash exposure is given either to a sheet of white paper placed over the original, or by means of a special flash lamp, which transmits a narrow beam of light through the lens diaphragm and the halftone screen apertures.

**Types of Negatives.** Different types of halftone negatives are required for some methods of halftone reproduction, the difference being mainly in the size of the high-light dots and the general contrast of the image. Halftone negatives for photoengraving (relief etching) must have larger high-light dots and a more "open" dot formation than those for photolithography and offset printing. Allowance thus is made for the reduction in dot size occurring during relief etching of halftone images, an operation not performed in direct photolitho halftone reproduction on grained metal plates.

J. S. MERTLE

**HALFWAY COVENANT**, a compromise in the history of New England Congregationalism adopted in 1657, and confirmed by a general synod in 1662, whereby nonregenerate persons of upright lives who were members of a Christian family, and who publicly approved the main truths of the gospel and promised to walk in fellowship with and under the discipline of the church, were admitted to all privileges except the Lord's Supper and participation in ecclesiastical affairs, and were granted the right to offer their children for baptism. The measure was last used in Charlestown, Mass. (1882).

**HALIBURTON, THOMAS CHANDLER**, 1796–1865, Canadian humorist, was born in Nova Scotia. He practiced law for a short time, served in the provincial assembly, and was elevated to the bench of the Supreme Court. In 1835 he began contributing to the *Novascotian*, a Halifax newspaper, a series of witty dialect sketches, employing the pseudonym "Sam Slick." Sam Slick, Yankee clockmaker and peddler, was the first notable literary character, aside from Seba Smith's less popular "Major Jack Downing," to use the American vernacular for the purpose of humorous exaggeration, and set the tone for a whole school of literary comedians. Haliburton intended some of Sam's drollery as wry political allegory or as sarcastic commentary on the foibles of his fellow citizens. The sketches were collected in *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville* (1836). A second and third series followed in 1838 and 1840, respectively, *The Attaché, or Sam Slick in England* in 1843. In 1856 Haliburton resigned from the supreme court and moved to England, where he was a member of Parliament for Launceston (1859–65). He also wrote *An Historical and Statistical Account of Nova Scotia* (1829). See CANADIAN LITERATURE for illustration.

**HALIBUT**, the largest and most important fish of the FLOUNDER family, *Pleuronectidae*. Exceeded in size



by few fishes, the halibut, *Hippoglossus hippoglossus*, may weigh as much as 300 to 400 pounds, although most of the market specimens average from 50 to 200 pounds. Its laterally compressed body is brown on one side, white on the other; both eyes are located on the colored side. The fish is extremely voracious, feeding principally on crustaceans, mollusks, and other fishes. The halibut is found in the northern waters of the Atlantic and Pacific oceans, ranging as far south as France on the English coast and New Jersey on the American coast of the Atlantic and northern California on the Pacific coast. It is one of the more popular food fishes.

**HALIBUT LIVER OIL** is a fatty oil obtained from the livers of the halibut, *Hippoglossus hippoglossus*, a large fish of the flounder family. The liver of this species is relatively small and yields less oil per unit weight than the cod liver, but it has a much higher vitamin content. Each gram of halibut liver oil contains about 60,000 units of vitamin A and 600 units of vitamin D. It is particularly useful as a source of vitamin A. Its dose is correspondingly smaller than that of COD LIVER OIL; from 6 to 10 drops daily is usually sufficient in infant feeding.

THEODORE KOPFANYI

**HALICARNASSUS**, an ancient Greek city of Caria in Asia Minor, situated on the Ceramic Gulf, present site of Bodrum, Turkey. Founded by Dorians from Argos and Troezen, it was a member of the Doris Hexapolis, from which it was eventually cut off. By the Peace of Antalcidas it came under Persian control. About 500 B.C. the domestic tyrant Lygdamis founded a dynasty which lasted for several generations. During the fourth century B.C. it was the capital of the rulers of Caria, the most celebrated of whom was Mausolus, in whose honor his wife Artemisia erected the Mausoleum, accounted one of the seven wonders of the world. In 334 B.C. the town was destroyed by Alexander the Great but the inhabitants resisted him and rebuilt their city. However, it never regained its ancient greatness.

**HALICZ**, town, U.S.S.R., in the Ukrainian Soviet Socialist Republic, at the confluence of the Lukwa and the Dnestr rivers and on the Lvov-Chernovtsy rail line; 70 miles SE of Lvov. The ruins of the medieval castle of the Russian princes of Halicz overlook the town. During the 12th century Halicz was the capital of the Halicz Principality, the earliest predecessor of modern Galicia. It was conquered by the Poles in 1340 and in 1386 incorporated into Polish territory. It passed to Austria in the first partition of Poland (1772). During World War I Halicz acquired considerable strategic importance as the key to Lvov, then known as Lemberg. It was first captured by the Russians late in August, 1914, and recaptured by the Germans in June, 1915, after a 19-day siege by German-Austrian-Hungarian armies. Halicz became Polish again in 1919, along with the whole of Galicia. In August, 1945, it was incorporated by a Polish-Soviet agreement into the Soviet Union. Pop. about 3,500.

**HALIFAX, CHARLES MONTAGU, EARL OF**, 1661-1715, English statesman and poet, was born in Horton in Northamptonshire. He became lord of the treasury (1692) and a year later created the national debt by raising a loan of £1,000,000. In the following spring, acting on Paterson's idea, he instituted the Bank of England, with a capital of £1,200,000. For this service he was appointed (1694) chancellor of the exchequer. In 1695 he carried out a reform of the coinage, and two years later became the first lord of the treasury. In 1699 he was forced to retire to the Lords as Baron Halifax, and accept the auditorship of the exchequer. On the accession of George I he was again made first lord of the treasury (1714). His most notable literary achievement was (in co-operation with Matthew Prior) a parody on Dryden's *Hind and Panther*, called *The Story of the Country Mouse and the City Mouse* (1687).

**HALIFAX, EDWARD FREDERICK LINDLEY WOOD, 1st EARL OF**, 1881- , British statesman, spent his early years in Garrowby, Yorkshire, and was educated at Eton and at Christ Church and All Souls colleges, Oxford. He entered public life as Conservative member of Parliament (1910-25). During World War I he served in France with the Yorkshire Dragoons. He became parliamentary colonial undersecretary (1921-22) and minister of agriculture (1924-25). As viceroy of India (1926-31) he played an important part in improving British-Indian relations. He was leader of the House of Lords (1935-38, 1940). Halifax's tenure of the post of secretary of state for foreign affairs (1938-40) was marked by appeasement of Nazi Germany. During World War II he was ambassador to the United States (1941-46). Halifax was the author of *Indian Problems* (1932) and *Speeches on Foreign Policy* (1940). See DUMBARTON OAKS CONFERENCE for a picture of Lord Halifax.

**HALIFAX**, municipal, county, and parliamentary borough, N central England, Yorkshire, in the West Riding, on the Hebble River near its confluence with the Calder, 16 miles SW of Leeds. Noteworthy are the 12th-century Perpendicular parish church of St. John the Baptist; the Renaissance town hall, designed by Sir Charles Barry; the Akroyd museum and art gallery; Piece Hall, built in 1779, a large market center where piece goods are displayed and sold; Heath Grammar School, founded in 1585; and the Rose and Crown Inn, where Defoe wrote *Robinson Crusoe*. The town owes its importance to the woolen and worsted and cotton textile mills and dyeworks. Other manufactures are carpets, iron and steel goods, and pottery. Coal is mined in the neighborhood, and flagstones are quarried. Elland, three miles south of Halifax, is considered a part of Halifax. Pop. (1950 est.) 98,480.

**HALIFAX**, capital and chief city of Nova Scotia, a port of entry on the W side of Halifax Harbor, one of the finest harbors in the world. Halifax is the eastern terminus of the Canadian National and the Dominion Atlantic railways and of several local lines. It is served by the Maritime Central Airways and the Trans-Canada Air Lines. The city is located on the eastern slope of a rocky peninsula jutting out into the harbor, which consists of a narrow neck of the Atlantic Ocean terminating in Bedford Basin and covering 10 square miles north of the city. It is open all the year, affording anchorage for the largest ocean vessels. Halifax is a distributing point for export trade.

#### Halifax, the capital of Nova Scotia

NATIONAL FILM BOARD



Lumber, flour, fish, rolled oats, potatoes, and other foodstuffs are transhipped to ports all over the world. The city's industries include confectionery factories, oil and sugar refineries, shipyards, foundries, wood-working mills, rope and cordage works, and cold storage plants. The imports are chiefly manufactured goods from the United States and Great Britain, and rum, fruits, sugar, and molasses from the West Indies.

Notable features of Halifax are the Citadel, an old fortification now dismantled; Point Pleasant Park; the Dominion Buildings; and several old churches, especially St. Paul's (1750), the oldest Protestant church in the Dominion of Canada. Among the educational institutions of Halifax are Dalhousie University, King's College, and Nova Scotia Technical College.

Halifax is the principal operation and training base of the Royal Canadian Navy. During World War II it became the principal base of the North Atlantic Escort Forces and the principal convoy base for the North Atlantic. His Majesty's Canadian Dockyard, in conjunction with other local shipyards provided a completely equipped repair, refitting, and service base for all types of Allied fighting ships.

**History.** Halifax has had a romantic history as a great naval base in several wars. Founded by a body of immigrants under Edward Cornwallis in 1749, it was named for the Earl of Halifax. It was a British Loyalist center during the American Revolutionary War and the War of 1812 and continued to be garrisoned by British troops until 1905, when defense was assumed by the Canadian government. On Dec. 6, 1917, a large area of the city was laid waste by an explosion in Halifax Harbor, following the collision of a French Line steamship "Mont Blanc," loaded with munitions, and a Norwegian relief ship "Imo." The toll included some 1,500 persons killed, about 10,000 injured seriously, and a property loss estimated at \$50,000,000. Practically all the northern and older part of the city, known as Richmond, was demolished by the terrific concussion or wiped out by the fires that followed. The rest of the city suffered severely, and part of the town of Dartmouth, on the opposite side of the harbor, was laid in ruins by the blast. Pop. (1951) 85,589. F. C. W.

**HALITE.** See SALT, COMMON.

**HALITOSIS**, also called **Fetor Oris** or **Foul Breath**, is caused by many conditions. The most common causes are pyorrhea, dental caries, follicular tonsillitis, adenoids, and atrophic rhinitis (ozena). Less common causes are acidosis, diseases of the bronchi and the lungs, intestinal obstruction, or cancer of the upper portion of the gastro-intestinal tract. Also, most persons object to the odor of alcohol, tobacco, onions, and garlic on the breath. Measures such as gargling with a 1 per cent solution of chloramine-T may afford temporary relief. Chlorophyll preparations, found of some value in combating infected wound odors, have been recommended for halitosis, but evidence that they are effective is inconclusive. Sometimes relief is obtained by proper use of the toothbrush. What an individual suffering from halitosis needs most, in addition to a better than best friend, is a complete examination of his oral cavity, and if this does not reveal the cause, a clinical study of the naso-laryngeal passages and gastro-intestinal tract. Then the successful treatment of the disease causing the halitosis will remove the offensive breath. THEODORE KOPpanyi

**HALL, CHARLES FRANCIS**, 1821-71, American explorer of Arctic regions, was born in Rochester, N.H. After a varied career in Cincinnati, Ohio, he became interested in the fate of Sir John Franklin's Arctic expedition, and spent two years (1860-62) in search of Crozier's party, traveling only with Eskimo guides. He later explored King William Land (1864-69) and found skeletons and other traces of Crozier's men. In 1871 Congress appropriated \$50,000 and a ship, the *Polaris*, for Hall to explore the North Pole.

He reached lat. 82° 11' N, but was halted there by an ice barrier. Hall died of apoplexy on returning to his observatory from a sledge trip to Cape Brevoort, Greenland. His explorations, and his *Arctic Researches, and Life among the Esquimaux* (1865) were valuable additions to modern knowledge of Arctic geography.

**HALL, CHARLES MARTIN**, 1863-1914, American chemist, discoverer of the electrolytic process of aluminum reduction. He was born in Thompson, Ohio, and studied at Oberlin College, where, after his graduation in 1885, he began work on an inexpensive method of extracting aluminum from bauxite and other ores. He owed his success a year later to the discovery that alumina could be electrolyzed if it were dissolved in such a flux as cryolite. On being granted a patent in 1889, Hall secured the financial assistance of ANDREW W. MELLON and other capitalists in promoting the Pittsburgh Reduction Company (later the Aluminum Company of America). He

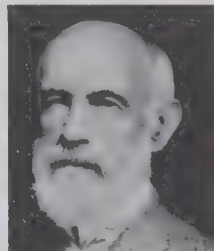


OBERLIN COLLEGE  
Charles M. Hall

served as vice-president in charge of technical operations at the plant, which was erected in New Kensington, Pa. By 1890 the company was turning out 40 tons of aluminum a year, and the metal which the Sainte-Claire Deville process had reduced in price to \$12 a pound was brought into common use at \$1.50 a pound. Five years later, when an electrolytic plant had been built at Niagara Falls, production was stepped up still further and a record price of 35 cents a pound was achieved. Hall's discovery was the means of spurring the development of the age of light alloys. His invention amassed for him a fortune of \$27,000,000 of which he gave one-third to Oberlin College. See ALUMINUM; ELECTROMETALLURGY. M. E. C.

**HALL, EDWARD**, c. 1499-1547, English chronicler, was a hearty supporter of Henry VIII, although allied to the advanced reforming party. The doctrine of "royal supremacy" he uncompromisingly taught in *The Union of the Two Noble and Illustrious Families of Lancaster and York* (1542). This work is the source upon which Shakespeare drew for some of his historical plays.

**HALL, GRANVILLE STANLEY**, 1844-1924, American educator and psychologist, was born in Ashfield, Mass. He studied at Williams College and Union Theological Seminary, and in Germany. Joining the teaching staff of Johns Hopkins University in 1881, he was soon given \$1,000 to set up a psychological laboratory, and in 1883 became professor of psychology and pedagogics. When Clark University was opened in 1889, Hall, by now a leader in the field of genetic psychology and an authority on secondary and higher education, became its first president. During most of his administration (1889-1919), he headed the Psychology Department and lectured, devoting himself to child-study. He founded the *American Journal of Psychology* (1887) and the *Pedagogical Seminary* (1891); was a founder and first president of the American Psychological Association (1891). Hall wrote: *Adolescence* (2 vols. 1904), his most important work; *Educational Problems* (1911); *Founders of Modern Psychology* (1912); *Jesus, the Christ, in the Light of Psychology* (1917); *Recreations of a Psychologist* (1920); *Aspects of Child Life* (1921); *Senescence* (1922); his autobiography, *Life and Confessions of a Psychologist* (1923).



L. E. DAVIS  
G. Stanley Hall



**HALL, ISAAC HOLLISTER**, 1837–96, American philologist and biblical scholar, born in Norwalk, Conn., and educated at Hamilton College. In 1875–77 he was connected with the Beirut College (Syria) and in 1876 found a Syriac manuscript of the Philoxenian version of the Acts, the Gospels and part of the Epistles, which he published in 1884. The Cypriot inscriptions were first translated by him, and from the Syriac manuscript found by the Rev. W. F. Williams he deciphered the “Antilegomena Epistles.”

**HALL, JAMES**, 1793–1868, American author and jurist, was born in Philadelphia, Pa., and was admitted to the bar in 1818. In Illinois he served as prosecuting attorney, then as circuit judge between the Ohio and Mississippi rivers. Named state treasurer (1828), he reorganized the state financial structure. He edited the *Illinois Intelligencer* (1829–32), founded the first literary periodical west of the Ohio in 1830, the *Illinois Monthly Magazine*, and wrote several books on the frontier.

**HALL, JAMES**, 1811–98, American geologist, born in Hingham, Mass. He graduated in 1832 at the Rensselaer Polytechnic Institute, where he was professor of geology from 1854 to 1876. Appointed to the Geological Survey of New York in 1836, he was placed in charge (1837) of the survey of the western part of the state. His report, published in 1843, laid the foundation for American stratigraphic geology and is regarded by geologists as a classic. It led to the permanent establishment of the office of state geologist, Hall receiving the appointment. He was also state geologist of Iowa in 1855 and of Wisconsin in 1857, was director of the New York State Museum (1866–93), and was president (1856) of the American Association for the Advancement of Science. His chief work is *Palaeontology of New York* (13 vols. 1847, et seq.). He also published more than 300 scientific papers.

**HALL, THOMAS SEAVEY**, 1827–80, American manufacturer and inventor, was born in Upper Bartlett, N.H., and studied at Middlebury College. From about 1846 to 1866 he was engaged in the manufacture of woollens. As a result of his experience in surviving a railroad wreck he became interested in railroad safety devices and invented an automatic block signal and several other electric signals. These were first installed on the eastern Railroad of Massachusetts (1871) and were later adapted for use on highways and drawbridges.

**HALL**, or **Schwäbisch-Hall**, town, Germany, in the state of Württemberg, on the Kocher River, 35 miles NE of Stuttgart. Features of interest include the St. Catherine's Church (14th century), a baroque town hall (18th century), a Fish Fountain (16th century), an old ruined fort, and many old houses. The Benedictine abbey, Great Kumburg, and the former nunnery, Little Kumburg, are near by. Hall is famous for its salt mines and saline waters. There are manufactures of leather goods, hardware, machinery, brushes, soap, and textiles and trade in grain and livestock. Hall was founded in 1037, and in 1276 it became an imperial city, with a mint. In 1802 it was absorbed by the state of Württemberg. Pop. (1946) 17,200.

**HALL**, in architecture, a room ranging in size from the great hall of medieval times to the small entranceway in modern homes. The use of the word “hall” to designate a public meeting place is an outgrowth of the early guild halls, which were designed on the principle of the medieval castle. In the ancient world, a section of a temple was often called a hall. The hypostyle hall in Egyptian houses of worship, the apadana in the Persian palace, and the tepidarium of the Roman thermae are examples of early versions of the hall. In the Middle Ages the hall was the center of the castle and the center of the medieval family's existence. It was used for dining, court ceremonies, gaming, entertainments of all kinds, and often for sleeping as well. In plan it was

very simple. At one end of the rectangular room was the entrance and at the opposite end was a huge fireplace. On either side of the fireplace was a door, one leading to a sleeping room and the other to the kitchen. Great tables were placed in front of the fireplace for meals. The hall rose to the height of the building with arched wooden beams forming its ceiling. In the more elaborate castles a balcony was built over the entrance for the use of musicians; tapestries, shields, and weapons hung on the wall. One of the best examples of the medieval hall is Westminster Hall, London. Built by William Rufus and restored by Richard II, the hall measures 300 by 100 feet. In Germany the great medieval hall was divided into sections by paneled and carved screens. In universities the hall was at first a dining room, but later the term included buildings which housed classrooms and reading rooms.

When the town became more important in the economic and social life of the time, guilds built meeting places which were called halls. From these guild halls came the town halls, centers of political life. In the United States the town hall assumed importance in the life of the nation. The best known halls, however, are places of entertainment, such as Carnegie Hall, New York, and Orchestra Hall, Chicago. In private dwellings the hall in its original sense has almost disappeared, and now serves as a passageway to other rooms.

HELEN STEWART

**HALL, FORT**, a fur-trading post on the left bank of the Snake River near its confluence with the Portneuf, built in 1834 by Nathaniel J. Wyeth, but sold three years later to HUDSON'S BAY COMPANY, which operated the fort until it was abandoned in 1855. Fort Hall was an important landmark on the famous OREGON TRAIL; here on July 27, 1834, the Rev. Jason Lee, Methodist missionary, held the first Protestant services in Idaho. The United States government reimbursed the British Hudson's Bay Company for the value of the fort in accordance with the terms of the Oregon Treaty (1846), which recognized complete American sovereignty over the region. The site is now within the Fort Hall Indian Reservation in southeastern Idaho. See IDAHO, History; OREGON, History.

## HALL OF FAME

*Bronze busts of great Americans stand in a crescent colonnade in New York City*

**HALL OF FAME FOR GREAT AMERICANS**, THE, is a semicircular colonnade on the University Heights campus of New York University, on Sedgwick Avenue between West 180th Street and Hall of Fame Terrace, and overlooking the Harlem River. The two-story building was a gift of Helen Gould (Mrs. Finley J. Shepard), daughter of Jay Gould, to the University in 1900. It was built by architect Stanford White. The 630-foot colonnade, about 30 feet high, joins the Gould Memorial Library, Baker Hall of Philosophy, and the Hall of Languages into a unified design. It contains niches for 150 bronze busts of famous Americans, with appropriate inscriptions.

### Hall of Fame at New York University



| HALL OF FAME                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Alexander Hamilton<br>Joseph Henry<br>Mark Hopkins<br>Elias Howe<br>Francis Parkman                                                                                                            |
| John Adams<br>John James Audubon<br>Henry Ward Beecher<br>William Ellery Channing<br>Henry Clay<br>Peter Cooper<br>Jonathan Edwards<br>Ralph Waldo Emerson<br>David Glasgow Farragut<br>Benjamin Franklin<br>Robert Fulton<br>Ulysses Simpson Grant<br>Asa Gray<br>Nathaniel Hawthorne<br>Washington Irving<br>Thomas Jefferson<br>James Kent<br>Robert Edward Lee<br>Abraham Lincoln<br>Henry Wadsworth Long-<br>fellow<br>John Marshall<br>Horace Mann<br>Samuel Finley Breese Morse<br>George Peabody<br>Joseph Story<br>Gilbert Charles Stuart<br>George Washington<br>Daniel Webster<br>Eli Whitney | 1920<br>Samuel Langhorne Clemens<br>(Mark Twain)<br>James Buchanan Eads<br>Patrick Henry<br>William Thomas Green<br>Morton<br>Alice Freeman Palmer<br>Augustus Saint-Gaudens<br>Roger Williams |
| 1905                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1925<br>Edwin Booth<br>John Paul Jones                                                                                                                                                         |
| John Quincy Adams<br>James Russell Lowell<br>Mary Lyon<br>James Madison<br>Maria Mitchell<br>William Tecumseh Sherman<br>John Greenleaf Whittier<br>Emma Willard                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1930<br>Matthew Fontaine Maury<br>James Monroe<br>James Abbott McNeill<br>Whistler<br>Walt Whitman                                                                                             |
| 1910                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1935<br>Grover Cleveland<br>Simon Newcomb<br>William Penn                                                                                                                                      |
| George Bancroft<br>Phillips Brooks<br>William Cullen Bryant<br>James Fenimore Cooper<br>Oliver Wendell Holmes<br>Andrew Jackson<br>John Lothrop Motley<br>Edgar Allan Poe<br>Harriet Beecher Stowe<br>Frances Elizabeth Willard                                                                                                                                                                                                                                                                                                                                                                          | 1940<br>Stephen Collins Foster                                                                                                                                                                 |
| 1915                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1945<br>Sidney Lanier<br>Thomas Paine<br>Walter Reed<br>Booker T. Washington                                                                                                                   |
| Louis Agassiz<br>Daniel Boone<br>Rufus Choate<br>Charlotte Saunders Cushman                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1950<br>Susan B. Anthony<br>Alexander Graham Bell<br>Josiah Willard Gibbs<br>Dr. William C. Gorgas<br>Theodore Roosevelt<br>Woodrow Wilson                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1955<br>Thomas Jonathan (Stonewall)<br>Jackson<br>George Westinghouse<br>Wilbur Wright                                                                                                         |

**Eligibility and Election.** The original plan was that 50 names should be chosen in 1900 and that five more should be added every five years, but this plan was never followed. At first nominations were limited to men of American birth, dead 10 years or longer. In 1922 nominations were restricted to persons dead 25 years or more, and eligibility was opened to women and to foreign-born Americans associated with the progress and welfare of the nation. Nominations are made by the general public, and names ratified by the senate of New York University are mailed to the electoral college of the Hall of Fame, consisting of about 100 distinguished persons in every state of the Union. The members of the electoral college are appointed for life by the director of the Hall of Fame in consultation with the chancellor of the university. Since 1945 election to the Hall of Fame has been by

majority vote. Public donations pay the costs of the busts and inscriptions, while New York University provides for the upkeep of the hall and for the salaries of the director and other personnel. At the first election 29 names were elected instead of the 50 under the original plan. By the end of 1955, 86 names had been chosen.

**HALLAM, ARTHUR HENRY**, 1811–33, English poet, son of Henry Hallam, the historian, was born in London, and studied at Eton and Trinity College, Cambridge. His early death inspired Tennyson's noble elegy of *In Memoriam*. His *Remains in Prose and Verse* were edited by his father in 1834.

**HALLAM, HENRY**, 1777–1859, English historian born in Windsor, father of ARTHUR HENRY HALLAM. After studying at Eton and Christ Church, Oxford, and practicing law, he became commissioner of stamps. A careful and critical historical investigator, his books include, *A View of the State of Europe During the Middle Ages* (2 vols., 1818); *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries* (4 vols., 1837–39); and a standard work, *The Constitutional History of England from the Accession of Henry VII to the Death of George II* (2 vols., 1827). He was a fellow of the Royal Society and trustee of the British Museum.

**HALLAND**, county, SW Sweden, bounded on the N by the county of Göteborg and Bohus, on the NE by Älvsborg, on the E by Jönköping and Kronoberg, on the S by Kristianstad, and on the W by the Kattegat; area 1,901 sq. mi.; pop. (1949) 161,266. It is a lowland with a fairly fertile clay soil, and has a number of small lakes. It is drained by the Viske, the Ätra, the Nissa, and the Lagan rivers, all of which empty into the Kattegat. Potatoes and grains are grown, livestock are raised, and dairying is important. There are large salmon fisheries. Other industries include granite quarrying, shipbuilding, brewing, and manufactures of timber products and clothing. The seat of the county and the largest city is Halmstad, a port on the Kattegat.

**HALLÉ, Sir CHARLES**, 1819–95, Anglo-German pianist and conductor, was born in Hagen, Westphalia. He studied music in Darmstadt and Paris, where he began a concert series in 1846. Forced by the Revolution of 1848 to go to England, he settled in Manchester and became conductor of the Gentlemen's Concerts (1850), the St. Cecilia Society (1852), and founded the Hallé Orchestra (1857). The performances of the Hallé Society of Manchester became famous and continued after the conductor's death. In 1893 Hallé became first principal of the Royal College of Music. He was knighted in 1888. His autobiography, *Life and Letters of Charles Hallé*, was published in 1896.

**HALLE**, or **Halle an der Saale**, city, East Germany, in former Prussian province of Saxony, now in Halle District, about 22 miles NW of Leipzig. It is the seat of the University of Halle, founded in 1694 and merged with the older University of Wittenberg in 1817. Other educational institutions in Halle are the Biological Institute of the Kaiser-Wilhelm Society, the Library of the Natural Sciences, the main library of the Francke Foundation, and numerous trade and technical schools. Here are, too, the asylums and schools founded (1698) by AUGUST HERMANN FRANCKE, Protestant religious leader and pedagogue. In the market place, the center of the old town, are the Red Tower (276 ft.), with a statue of Roland, and a monument to *Handel*, a native of the city. Notable religious buildings in Halle include the St. Moritz Church (12th century), the St. Mary's Church (16th century), and the 16th-century cathedral. The most notable of the secular buildings are the partly ruined citadel Moritzburg (1484–1503), formerly a residence of the archbishops of Magdeburg; the town hall (14th century); the ruined castle of Giebichenstein; and the University (see HALLE, UNIVERSITY OF).

Manufactures include machinery, metal goods,



paper and books, wood products, paraffin, playing cards, sugar, beer, and vehicles. The salt mines of Halle, ancient in their origin, are mined by men known as "Halloren," with their own customs and code.

Halle originated early in the 9th century and was first mentioned as a town in 1064. It was a prosperous Hanse town in the 13th and 14th centuries. It became Lutheran in 1541. In 1648 Halle passed by the Treaty of Westphalia, to the House of Brandenburg. From 1806 to 1814 it formed part of the kingdom of Westphalia. It was given to Prussia in 1815 by the Congress of Vienna. Halle was severely damaged during World War II. It was captured by the U.S. First Army in the middle of April, 1945, and was included in the Soviet occupation zone. Pop. (1946) 223,000. A. M. K.

**HALLE, UNIVERSITY OF.** Founded in 1694, the Martin Luther-Universität Halle-Wittenberg in Halle, Germany, is one of the oldest universities in Europe. In 1817 the University of Wittenberg became a part of Halle. There are five faculties: theology, law and economics, medicine, philosophy, and natural science.

**HALLECK, FITZ-GREENE,** 1790–1867, American poet, born in Guilford, Conn. For 20 years he was a clerk in a New York bank, and afterwards became private secretary to John Jacob Astor. He published the satirical series "The Croakers" (with Joseph R. Drake) in the *New York Evening Post* (1819) and *Fanny* (1819), a satiric poem. His best poems are those on "Alnwick Castle" and "Burns," his "Marco Bozaris," and his poem written at the death of his friend Drake and beginning "Green be the turf above thee."



CHICAGO HIST SOC

Fitz-Greene Halleck

**HALLECK, HENRY WAGER,** 1815–72, American general, born in Westerville, N.Y. He graduated at West Point in 1839, was employed as a military engineer on the fortifications of New York (1841–46), and during the Mexican War he was stationed on the Pacific coast, saw active service in Lower California, held various administrative offices in California, and in 1849 was a member of the committee which drafted the state constitution. He resigned from the army in 1854, was a lawyer, railroad president, and mine operator in California until 1861, re-entered the army on the outbreak of the Civil War, and distinguished himself as commander of the Department of Missouri, Nov. 1861–Mar. 1862. He planned the western campaign of 1862, was commander in chief of the U.S. Army (1862–64), and was then General Grant's chief of staff until the close of the war. He wrote *Elements of Military Art and Science* (1846), much used during the Civil War; and *International Law* (1861).

**HALLELUJAH,** a word which forms part of the praises both in Jewish and in Christian liturgies. Psalms 113–118 are known as the great hallelujah, and were sung by the Jews at the Passover feast. In the Book of Common Prayer of 1549 "Alleluia" was inserted after the first Gloria Patri at matins and evensong, to be said from Easter to Trinity Sunday. The Prayer Book of 1552 substituted the translation "Praise ye the Lord," with the response "The Lord's name be praised."

**HALLER, ALBRECHT VON,** 1708–77, Swiss anatomist, physiologist, and botanist, was born in Bern and studied at the universities of Tübingen, Leiden, and Basel. He was appointed professor of anatomy, surgery, and botany at the newly established University of Göttingen (1736) and there conducted several hundred experiments which enabled him to

distinguish between irritability (or muscular contraction) and sensibility (or nerve impulse). Finding that these responses generally resulted from the effects of various stimuli, whether mechanical, chemical, electrical, or emotional, he became known as the greatest systematist after Galen. He retired to Bern (1753) to write *Elementa physiologiae corporis humani* (8 vols. 1757–66). He was also noted as the author of the descriptive poem *Die Alpen* (1729) and the didactic poem *Vom ursprung des uebels* (1734).  
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**HALLEY, EDMUND,** 1656–1742, English astronomer, was born in London and studied at Queen's College, Oxford. His stellar observations at St. Helena in 1676 earned him the title of the "Southern Tycho," because they ascertained the positions of the important fixed stars in the southern hemisphere and thus supplemented the work of FLAMSTEED in the northern hemisphere. In 1698–1700 he investigated the variation of the compass at different latitudes in the Atlantic, and inferred the magnetic relations of auroras from his observations of the display on Mar. 16, 1715. He also advocated the determination of the solar parallax from the transit of Venus which was to take place across the sun in 1761. The formulation of Newton's laws of gravitation led him to believe that comets must revolve around the sun in greatly elongated orbits, and he accordingly predicted in 1705 the return in 1758 of the comet which had been previously observed in 1456, 1531, 1607, and 1682. This comet is today known as Halley's comet. He was appointed Savilian professor of astronomy at Oxford in 1703 and, having succeeded Flamsteed as astronomer royal in 1721, carried out at the Greenwich Observatory a cherished design of observing the moon over an 18-year period. The scientific world was indebted to him for publishing Newton's *Principia* at his own expense in 1687. M. E. C.

BIBLIOG.—H. S. Williams, *The Great Astronomers* (1930).

**HALLIBURTON, RICHARD,** 1900–1939, American author, was born in Brownsville, Tenn. After graduating from Princeton University in 1921, he tramped through Europe, Asia, and Central America, assiduously courting adventure and retracing the itineraries of Ulysses, Alexander, Hannibal, and Cortes. His *Royal Road to Romance* (1925), *The Glorious Adventure* (1927), and *New Worlds to Conquer* (1929) were romantic reports of his travels. *The Flying Carpet* (1932) was an account of a leisurely flight around the world. He was lost at sea in 1939 when he attempted to cross the Pacific in a junk.

**HALLOWEEN,** last day of October, the day preceding All Saints' Day in the Christian church; hence, Allhallows Eve. Numerous ancient practices on Halloween, still continued in many places, have their origin in pagan festivities. Centuries ago the day was considered the time of year in which both good and evil spirits roamed the earth; it was a night of ghosts and fairies in which bonfires were built and futures were foretold and witches rode the sky on brooms. It was also the last night of the year by the ancient Celtic calendar, a time when evil souls went abroad and sorcerers and sorceresses wandered about predicting what the new year held in store. The Druids, medicine men of the Celtic priesthood, celebrated a harvest festival at this time in dedication of the winter fund of fruits. This was obviously the origin of Nutcracking Night and the originally superstitious game of bobbing for apples. The customary bonfires and fortunetelling are probably an outgrowth of the Druidical cults pertaining to the sun and the dead. The relation with the past, of present popular customs of masquerading, masking, and the lighting of pumpkin-lanterns, is easily recognized. Practices of prankish destruction on Halloween night are corruptions of earlier beliefs in the power of wicked witches.

In the opinion of some historians the establishment of the Christian feast of All Saints' Day and the

ancient secular customs in vogue on the day preceding was but a coincidence, with no specific connection existing between them.

R. T.

**HALLSTATT PERIOD**, the name given to the first division of the Iron Age in central and northern Europe. The second stage is known as LA TÈNE. It is named from a great burial ground in Austria in which the most representative materials of this stage were found. Many other sites are known from central Europe and a lesser number from farther north, west, and east. The period lasted from about 900 to 500 B.C. and represents an interesting transition from the use of bronze to iron. Because of this and because of the presence of important iron deposits near Hallstatt some scholars have been inclined to look to this area for the origin and development of iron working. This, however, is doubtful. Objects placed with the dead ranged from weapons—spears, swords, battle axes, shields and the like—to brooches and other jewelry. Remains of their villages as well as pictorial records placed on the exterior of jars tell us of a very backward people with no development of masonry, who were just beginning to make use of ox-carts but who were still without the potter's wheel or millstone. Writing and coinage were still unknown to them. Yet just to the south, along the Mediterranean, the high civilizations of Greece and Rome were flourishing. See PREHISTORIC ARCHAEOLOGY.

**HALLSTATT**, town, Austria, in the province of Upper Austria, on the W shore of the lake of the same name, in the Salzkammergut near the border of Salzburg. Its necropolis, with probable Celtic remains, has given the name to the HALLSTATT PERIOD, the final stage of the bronze age and the first stage of the Iron Age in Europe. Hallstatt was founded by Duke Albert I in the 13th century. Pop. about 1,300.

**HALLUCINATION** has been defined as false sense impression—i.e., a person hears an imaginary voice or sees an object which has no real existence. Marked or persistent hallucinations are a symptom of mental disorder. Hallucinations are closely associated with delusions as they have many common characteristics and are generally coexistent. The difference between the two is that DELUSION is a false belief and not a false sensation. Hallucination and ILLUSION often have been confused; however, in illusion a sensory object is present and apparent to others, but it is interpreted as something different.

Various kinds of hallucinations include visual, auditory, tactile, referring to any of the senses to which the false sensation may belong. Visual and auditory hallucinations are the most common. A visual hallucination may occur simply as a flash of light; however, the more complex sensations are more common—i.e., those of particular objects or of whole scenes. Auditory hallucinations generally take the form of voices which may be either pleasant or unpleasant in character. These "voices" often are abusive or reproachful. Hallucinations are commonly found in such disorders as PARANOIA, SCHIZOPHRENIA, and those accompanying starvation. They are frequently associated with certain drug poisonings such as occur with morphine, cocaine, and alcohol (see DELIRIUM TREMENS; DRUG ADDICTION).

Hallucinations are often a result of dissociation of the consciousness. A group of ideas is said to be dissociated when it is separated from the normal personality and when its course and development are independent of the control of the personality. Although hallucinations form a part of the consciousness, the system of ideas which the hallucination expresses are to be regarded as a dissociated portion of the person's consciousness. Dissociation is a result of mental conflict which has strong emotional tone. Conflict results when the person is confronted with two incompatible and contradictory systems of ideas, and the conflict between them is avoided by dissociating one from the other. The field of consciousness is separated into logic-tight compartments between

which there is no communication. Thus, it can be seen that a characteristic feature of hallucination is that persuasion and reason are altogether ineffectual against it.

Many hallucinations are a result of an abnormal physiological condition. A pathological condition along a nerve tract may be traced to its sensory end-organs and detected as if it were a normal stimulation. It is known that voices are often heard when there is a disease of the inner ear, and that peculiar odors are imagined when the olfactory membranes are diseased. In the disease of locomotor ataxia, the patient feels as if pins were being thrust into his legs. In general, however, the physiological basis behind these abnormal sensations is not well understood. See MENTAL DISORDERS.

**HALMAHERA ISLAND**, or Jilolo, the second largest of the Moluccas, Netherlands-Indonesian Union, the Republic of Indonesia, Maluku Province; it was formerly a part of the East Indonesian State; located midway between the extreme W shore of New Guinea and Celebes, with a part of its S peninsula lying S of the Equator and the remaining three peninsulas lying N; area 6,500 sq. mi.; pop. about 110,000. Halmahera, shaped somewhat like Celebes, has four long peninsulas, all heavily forested and mountainous, with three active volcanos on the west coast and one on the east coast. The greatest elevation (4,947 ft.) is in the central part, where the four peninsulas join; the northeastern peninsula rises to 3,707 feet, the north to 4,347 feet, and the south to 4,100 feet. The four peninsulas enclose three wide bays: Kaoe to the north, Boeli and Weda to the east and south.

Halmahera has no large rivers, the Ka-u being navigable for small craft only, but there are a number of smaller streams. Sago and rice are cultivated in the coastal areas; native occupations are hunting, fishing, and gathering wild nutmeg and ironwood in the forests. There has been some missionary work on the island, and it is claimed that 10,000 of the population are Christian. There are some Mohammedans, and the remainder are pagans. The natives are members of more than 30 separate tribes and range in color from the Papuan black to lighter than the Malay.

Travel on Halmahera is difficult because of the rugged terrain and the dense forests. During World War II the coastal regions were occupied by the Japanese, and some 8,000 of them here and on near-by Morotai, surrendered to the Allies on Aug. 29, 1945.

C. S.

**HALMSTAD**, city and seaport, SW Sweden, seat of Halland County, on the Kattegat at the mouth of the Nissan River; 75 miles SE of Göteborg. The Nicholas Church, built in 1462, is the chief building of interest in the city. Halmstad has shipbuilding yards, fisheries, engineering works, and manufactures of clothing, beer, machinery, paper, and wood pulp. Granite is quarried. At one time a part of Denmark, Halmstad was ceded to Sweden in 1658. Charles XI routed the Danes here in 1676. Pop. (1949) 34,230.

**HALO**, the phenomenon of a colored or white circle around the sun, or sometimes the moon. Halos are caused by light passing through high clouds of ice crystals. REFRACTION through the hexagonal crystals produces colored halos, while reflection from the crystal faces gives white ones. Halos always appear at definite distances from the luminary. Most common is the inner halo, a circle or arc of 22° radius. Sometimes there is a second outer halo of 46° radius. Colored halos have red on the inside with tinges of yellow, green, and blue in sequence. A white *parhelic circle* may pass through the sun parallel to the horizon, with images of the sun, called *parhelia* or "mock suns," where it crosses the halo. A *corona* is a similar ring due to fog or mist. It appears at variable distances from the sun but always closer than 22°, with the red on the outer side.



**HALOGEN**, a member of the chlorine family of elements, group VII B of the periodic table (see PERIODIC ARRANGEMENT OF THE ELEMENTS). These elements are fluorine, chlorine, bromine, iodine, and astatine. Astatine is a short-lived synthetic element whose properties have been discovered by tracer methods. The others resemble each other in many respects. All are active nonmetals, fluorine being the most active. Therefore they are never found uncombined in nature. In the elementary form, they are all very destructive of tissue. Each forms strong acids to which it supplies the negative (halide) ion having the valence  $-1$ . The salts of these acids give the group its name, which means "salt-formers." Compounds of chlorine, bromine, and iodine occur in sea water. The halogens may also have various positive valences, and can form interhalogen compounds and organic halides.

**HALPINE, CHARLES GRAHAM**, 1829–68. American poet and journalist, was born in Ireland. He came to the United States in 1851 and for a time was secretary to P. T. Barnum. In 1852 he was co-editor, with B. P. Shillaber, of the *Carpet-Bag*, a Boston humorous weekly, but soon moved to New York, where he worked for the *Herald*, the *Times*, and the *Leader*, and was active in Tammany politics. During the Civil War he was on the staff of General Hunter and was brevetted brigadier general at the close of the war. As a writer he was best known for his poems about the war, especially "Sambo's Right to be Kilt," justifying the enlistment of a Negro regiment, and *Miles O'Reilly His Book* (1864), a collection of humorous verse.

**HALS, FRANS**, c. 1580–1656, Dutch portrait painter, was born in Antwerp but settled in Haarlem (1616). In the Dutch school he was the pioneer of free, broad brushwork and is famous also for his masterly juxtaposition of flesh tints. He chose for his



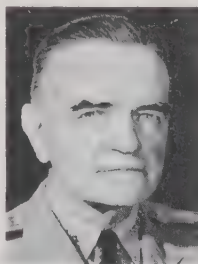
SCHAEFFER GALLERIES

"Fisher Boys," a painting by Frans Hals

portraits subjects varying from prosperous guildsmen to carousing tavern habitués. The former may be illustrated by his "Governors of the St. Elizabeth Hospital," sober and reminiscent of the later "Syndic" of Rembrandt. From his numerous genre pictures, and tavern "Banquet of the Officers of St. George's Shooting" and "The Merry Company," showing his splendid portrayal of laughter, are notable.

**Dirk Hals**, c. 1591–1656, a younger brother of Frans, is remembered for his social pictures of young people, assembled at dinner, dancing, talking, or listening to music.

**HALSEY, WILLIAM FREDERICK**, 1882–, American naval officer, was born in Elizabeth, N.J., attended the University of Virginia and U.S. Naval Academy. Commander of a destroyer in World War I, he was assigned to the Office of Naval Intelligence



OFFICIAL U.S. NAVY PHOTO

William F. Halsey

in 1921 and served as naval attaché in Germany until 1925. After duty at Annapolis (1927–34), he successfully qualified as a naval aviator at the age of 53. A leader in the naval air program (1935–40), he became commander of Aircraft Battle Force in 1940 with the rank of vice admiral; when Pearl Harbor was attacked in 1941, he was commander of Task Force 2 of the Pacific Fleet. In January, 1942, he commanded the first offensive operation of the United States in World War II, the historic raid on the Japanese-held Marshall and Gilbert Islands. In April, 1942, he headed the task force which launched General Doolittle and his Army flyers on their Tokyo raid. Named as commander of the South Pacific Force in October, 1942, Admiral Halsey was in tactical command of the Solomons campaign. As commander of the Third Fleet (1944–45), he directed the naval action in the Philippines and the bombardment of Japan. Named a fleet admiral in 1945 and given that rank permanently in 1946, he retired in 1947. With J. Bryan III, he wrote *Admiral Halsey Tells His Story* (1947).

B. F. C.

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**HALSINGBÖRG**, or **Helsingborg**, city, and seaport, S Sweden, in Malmöhus County, on the narrowest point of the Sound (Öresund), three miles from Helsingör, Denmark, and 35 miles NE of Copenhagen by water and railway ferry. An interesting feature of the city is its 12th-century fortress, with a high square tower. An important manufacturing town, Helsingborg has copper, India-rubber, and phosphate works, sugar refineries, and breweries. Coal and potter's clay are found in the vicinity. Helsingborg, a trade center of Scandinavia since the ninth century, belonged to Denmark until 1658. Pop. (1949) 70,776.

**HALSTED, WILLIAM STEWART**, 1852–1922, American surgeon, was born in New York City and studied at Yale University and the College of Physicians and Surgeons (now part of Columbia University). After further work in Vienna, he returned to New York. From 1889 to 1922 he was professor of surgery at Johns Hopkins University. In addition to devising improved surgical techniques for cancer of the breast, hernia, and intestinal conditions, Halsted was a pioneer in the use of conduction and infiltration ANESTHESIA. Among his other innovations were the use of sterile gloves during operations and silk ligatures. In his association with SIR WILLIAM OSLER, HOWARD A. KELLY, and WILLIAM H. WELCH he became known as one of "the big four" of Johns Hopkins.

HALYS. See KIZIL IRMAK.

**HALYSITES**, a genus of fossil chain corals found in the Paleozoic rocks of North America, Europe, and Australia. In cross section the mass shows a characteristic chainlike appearance, hence the name.

**HAM**, a word used in the Bible with four different meanings: (1) one of the three sons of Noah, the other two being Shem and Japheth (Gen. 5:32); he was the father of Cush, Mizraim, Phut and Canaan (Gen. 10:6); (2) a place occupied by the Zuzims (Gen. 14:5); (3) an alternative name for the land of Egypt, used in the Psalms (Ps. 78:51; 105:23; 106:22); (4) the early inhabitants of the valley of Gedor (I Chron. 4:40).

HAM. See EAST HAM; WEST HAM.

**HAM**, town, France, in the department of Somme, on the Somme River, 35 miles SE of Amiens. It has a 12th-century abbey and a chateau (1216) which later became a state prison. Its inmates included many famous persons, among them Joan of Arc, the prince of Condé in the 16th century, the prince of Polignac and the ministers of Charles X, the general Cavaignac, and Napoleon III, who escaped in 1846. Pop. (1954) 3,598.

**HAM**, as in ham and eggs. See **MEAT**.

**HAMA**, or **Hamath**, ancient **Epiphania**, mentioned in Num. 13:21; a Syrian city on the Orontes River, between Damascus, 110 miles SW, and Alep (Aleppo), 75 miles NE. Hama was one of the three towns of the Hittites and was finally conquered by the Assyrians in 854 B.C. Moslems captured it A.D. 639; crusaders recovered it in 1108; and Moslems took it again in 1115. The deity of Hamath was called Ashima (II Kings 13:30), or Eshmun, and was one of the chief Hittite deities. Horse raising and trading is the leading occupation of the inhabitants, who are largely Bedouins. Hama has always been an important place on the trade route from Assyria to Egypt. There are manufactures of silk, cotton, and woolen materials. Pop. (1951) 150,892.

**HAMADAN**, city, W central Iran, capital of Hamadan Province, situated at a height of 6,000 feet immediately N of Kuh-i-Alwand (11,719 ft.), 180 miles SW of Teheran, 230 miles NW of Isfahan. The city's narrow and sometimes winding streets are crossed by broad, tree-shaded avenues that meet to form a plaza in the city's center. Hamadan is one of the chief trade and distribution centers of Iran; roads lead from it in all directions. It is one of Iran's oldest centers for the production of fine rugs and also produces leather, shellac, felt, silk goods, and copper work. The summer temperatures are cool, and Hamadan is a summer resort. The winters, however, are severe, the city receiving heavy snows. Hamadan is one of the world's oldest cities. In the 12th century B.C. it was known as Amadana, "place of meeting of many ways." About 800 B.C. Semiramis is reported to have built herself a summer palace here to escape the heat of the Mesopotamian plains. In the seventh and early sixth centuries B.C. the city was known as Ecbatana, and was the capital of the Medes, who brought the treasures of Nineveh to the city for safe-keeping. The tombs of Esther and Mordecai are reputed to be here, and the supposed tomb-site is a place of pilgrimage for the Jews. Hamadan was one of the Achaemenian (550–330 B.C.) capitals, and great temples and palaces were built. It was captured by Alexander the Great in 330 B.C. In World War I Hamadan was occupied by the Russians. During World War II the road constructed by the Persian Gulf Command to supply the Russians (Khorramshahr to Kazvin) passed through the city. The population of Hamadan is about one-fourth Turk or of Turkish descent and includes some 5,000 Jews and a few Armenians. Pop. (1952) 128,057.

**HAMADRYAD**. See **COBRA**.

**HAMADRYAD**. See **NYMPHAE**.

**HAMAMATSU**, city, Japan, Honshu, Shizuoka Prefecture, near the Hamana-Ko lagoon where it touches the SE coast, some 130 miles by rail SW of Tokyo. Once a center of hand weaving, it now has many small electric-powered weaving industries and also has factories for the manufacture of pianos, organs, and dyes, which during World War II were converted to the making of airplane parts. A feudal castle, built in 1571 by the Tokugawa shogun Ieyasu, has been destroyed. There is a famous annual competition in kite flying held here. Under attack by U.S. bombers and naval guns in World War II, more than half of the city was destroyed or damaged. After World War II woodworking and the manufacture of textile machinery, hats, film, and cellophane became leading industries. There are large chemical laboratories and a tangerine experimental farm. The

city was made a military training center with a large airfield and bomb testing ground in the late 1950s. A national air defense academy is located there. Pop. (1955) 268,792.

**HAMAR**, city, SE Norway, seat of Hedmark County, on the E shore of Lake Mjøsa, 62 miles N of Oslo. The city has manufactures of furniture, shoes, and knit goods. There are railway repair shops. The city's history dates from 1152 when the Hamar bishopric was established. The town was destroyed by the Swedes in 1567. Pop. (1950) 11,689.

**HAMATH**. See **HAMA**.

**HAMBACH**, village, Germany, in the state of Bavaria. It is notable as the scene in 1832 of a popular demonstration (Hambacher Fest) that proclaimed the sovereignty of the people as the foundation of organized government. Pop. 2,500.

**HAMBRIDGE, JAY**, 1867–1924, American art writer and artist, was born in Canada. He left home at the age of 15 and while working as a reporter for the *Kansas City Star* and the *New York Herald* became interested in art. After exhibiting a few pictures, this interest restricted itself to the belief that Greek design had a certain "principle of proportion" that was mathematically discoverable, and much of the remainder of his life was spent in verifying and supporting this theory. He published *Dynamic Symmetry* (1917), *Dynamic Symmetry: The Greek Vase* (1920), and *The Parthenon and Other Greek Temples: Their Dynamic Symmetry* (1924).

**HAMBORN**. See **DUISBURG**.

**HAMBURG**, or Freie und Hansestadt Hamburg, city and state, NW Germany, on the Elbe River at the confluence of the Alster and Bille; surrounded by the West German states of Schleswig-Holstein on the N and NE and Lower Saxony on the SE and S, and by the North Sea on the W; 156 miles NW of Berlin; area 288 sq. mi.; pop. (1956) 1,792,900. The city-state of Hamburg is divided into seven administrative districts: Central Hamburg, Altona, Eimbüttel, Northern Hamburg, Wandsbek, Bergedorf, and Harburg. The city-state government is made up of a House of Burgesses consisting of 120 members. Members of the House in turn elect an executive body of 15 members known as the Senate. The president of the Senate is also the mayor of Hamburg.

**The Port**. The international importance of the port is due to its unusually fine location: on the ocean at its point of deepest penetration into Europe; on the Elbe, navigable far inland; on a railway system leading to all parts of Germany and to neighboring countries; and, finally, on the canals connecting the Elbe River with the Rhine, the Oder, and the Baltic Sea. Before World War II the greater part of the harbor was occupied by free port facilities granted to the city of Hamburg in 1888 when it entered the

**Old Part of Hamburg** is interlaced by numerous canals. This is a prewar view of the German city





German customs union. This harbor is located on the left bank of the river opposite Hamburg proper; the area of the harbor is 10,000 acres, about half of which is covered by water. There are also numerous narrow but deep canals, called *Fleete*, in the old part of the city. The total water frontage is 105 miles, of which 50 lie in the free port; there were, before the war destruction, 22 miles of berthing space for sea-going vessels and 10 miles for river craft. State-built quays connect with the German railways by railway spurs. The city proper is entered by two small rivers: the Bille in the eastern part, and the Alster, forming a large sheet of water within the town and divided into two connected lakes, the Aussen-Alster and the Binnen-Alster. The inner town, lying between the Binnen-Alster and the Elbe, contains the commercial district and business houses; the residential quarters are situated around the Aussen-Alster; the entire area located on the shores of the Elbe river is occupied by the port, the docks, and the shipbuilding industry. In the west, Hamburg borders Altona, its twin city, which was destroyed in World War II. In the northwest, north, and east, Hamburg is surrounded by a ring of suburbs; the Elbe River forms the southern boundary, and beyond the Elbe to the south are the neighboring towns of HARBURG-WILHELMSBURG and their suburbs. Before World War II Hamburg was one of the commercial centers of the world.

The chief industries of the city have been shipbuilding, chemical works, construction, coal utilization (including gasworks), oil and grease manufacture, flour mills, woodworking and lumber, iron and metal, metallurgy and rubber. There was also an enormous industry in big aircraft, armaments and submarines, and food plants and oil refineries.

**Features of Interest.** Hamburg until World War II was a modern town in appearance, having been practically rebuilt since the big fire of May, 1842, in which two-fifths of the city was destroyed. Among the more noteworthy buildings is the city hall, erected in 1886-97, which was only slightly damaged in World War II. The beautiful steeple of great St. Michael's Church, the landmark of Hamburg, is still standing, although the church itself was destroyed by incendiary bombs. The medieval church tower of St. Nicholas, one of the loftiest in Europe, suffered serious damage to its foundations in World War II. The museum and the railroad stations remained standing despite considerable damage by bombing. Also preserved is the huge Chile House, a unique office building in the shape of an old Hanseatic ship, built of glazed reddish and blue-hued tiles. All the bridges are undamaged. The medieval churches of St. Catherine and St. Jacob are gone, as are the University, the opera house, and the skyscraper of the Hamburg-American Shipping Line. One of the main points of interest, the famous Hagenbeck Zoo at Steelingen, in the territory of Altona, suffered very heavy damage; 160 large animals and several hundred smaller ones were killed by incendiary bombs (see HAGENBECK, KARL).

Seventy per cent of the buildings of Hamburg were destroyed, and all Hamburg east of the Alster river from North Barmbeck to the slums of Billbrook and Rothenburgsort was annihilated. In the downtown business district the massive façades, though blackened, were still standing at the close of the war, but with nothing left behind them. The world-famous amusement center of St. Pauli was utterly ruined; so were the docks of the port except for the oil port, which was only slightly damaged.

**History.** Hamburg was founded under the name of Hammaburg by Charlemagne, about 808. In 1241 it formed an alliance with Lübeck, a treaty which became the basis of the HANSEATIC LEAGUE. From 1510 until 1937 Hamburg was a free state. The Reformation was introduced in 1529. In the 16th and 17th centuries many Spanish and Portuguese Jews persecuted in their native lands fled to Hamburg; at the end of the 17th century the HUGUENOTS fleeing

from the religious fanaticism of Louis XIV came to Hamburg by the thousands. As the nations of the American continent became free, Hamburg's overseas trade grew rapidly. During the French Revolution and the Napoleonic Wars the port suffered a serious setback. Napoleon incorporated Hamburg into the French Empire in 1810; it was not until May, 1814, that the city, after suffering much hardship and destruction, was taken by the allies. It recovered rapidly after the great fire of 1842. In 1867 Hamburg joined the North German Federation and became a federal state of the German Reich in 1871. An epidemic of cholera in 1892 proved a terrible setback to the development of the city.

Hamburg did not suffer any damage in World War I, but in November, 1918, the mutiny of the sailors of the German navy brought turmoil to the city during several weeks. Also, in October, 1923, it was the scene of an attempted communist revolution, which was crushed only after much bloodshed. In January, 1937, Hamburg received from Prussia, besides Altona, the twin towns of Harburg-Wilhelmsburg and a chain of suburbs. In return Hamburg had to transfer the seaport of CUXHAVEN to Prussia. After that time Hamburg became a city-state in the literal meaning of the word, though like all other German states it was deprived of its statehood by the Nazis and became a mere administrative unit governed by a Hitler-appointed *Stathalter*. However, the city kept a certain amount of self-administration. Hamburg was the only German city in which the Nazis were never able to crush the opposition. It was also the only city in which the populace demonstrated against the government when the Jews were deported.

Hamburg was one of the most bombed cities during World War II. The incendiary bomb raids, particularly in June and July, 1943, and in the summer of 1944 were among the heaviest in air warfare. Hamburg surrendered to the British without a fight on May 3, 1945. After the war it fell within the British zone of occupation. F. C. W.

**HAMBURG**, town, NW New York, Erie County; on the Erie Railroad, at the juncture of U.S. highways 62 and 219, about eight miles S of Buffalo in a dairy- and truck-farming region. Hamburg was founded by German immigrants in 1808 and named for their former home. The town is chiefly a farm market center but has some steel-working plants. Pop. (1950) 6,938.

**HAMDEN**, town, S Connecticut, in New Haven County, adjacent to the city of New Haven of which it is a residential and manufacturing suburb. Hamden was first settled in 1664. The manufactures include car lighting equipment, radiators, cotton yarn, building tile, brick, and pruning shears. Pop. (1950) 29,715.

**HAME**, department of SW Finland; bounded on the N by Vaasa, on the W by Turku Pori, on the S by Uusimaa, and on the E by Mikkeli. The capital is Hämeenlinna.

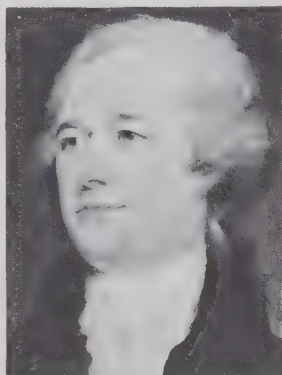
**HAMELN**, English *Hamelin*, town, Germany, in the Prussian province of Hanover, on the Weser River, 35 miles by rail SW of the city of Hanover. Because of its strategic location protecting an important passage over the Weser, the town, founded in the ninth century, saw heavy fighting in the Thirty Years' War, the Seven Years' War, and the Napoleonic Wars. During World War II on the night of April 7-8 Hameln was heavily shelled by American forces who occupied it in the morning. Many of the famous medieval buildings were destroyed, among them the "Honeymoon House." However, the Pied Piper House, erected in 1602, survived. It bears the inscription: "In the year 1284 on the day of John and Paul, 130 children born in Hameln were led to their deaths by a Pied Piper and lost in Koppen Mountain." The legend versified by Browning is said to be founded on an authentic incident of June 26, 1284. Before World War II Hameln was noted for its salmon fisheries and a school for apprentice seamen of the merchant marine. Pop. (1946) 31,800.

**HAMI**, or **Qomul**, Russian **Khamil**, an oasis and trading center of W China, Sinkiang Province, on the S side of the Tien Shan, NE of the Tarim Basin, and near the W edge of the Gobi Desert; 60 miles S of Barkol. The area of the oasis is 12 square miles, and it lies on a plateau about 4,000 feet above sea level. Hami is on two main caravan roads from China to the north and to the west. It is very fertile, producing wheat, barley, oats, millet, and excellent melons. Pop. about 7,000.

**HAMILCAR**, or **Hamilcar Barca**, d. 228 B.C., Carthaginian general, the father of Hannibal, to whose family the designation "Barcine" was afterward attached. He took command of the Carthaginian forces in Sicily during the first Punic War in 247 B.C., and maintained his position near Panormus (Palermo) in spite of all the endeavors of the Romans to expel him, abandoning the island only after the Roman naval victory off the Aegatian islands in 241 B.C. After suppressing a revolt of the Carthaginian mercenaries (240 to 238 B.C.), he set about the conquest of Spain, to compensate for the loss of Sicily and Sardinia, and to provide a basis for a campaign against Rome. His success was notable, and before his death in battle he had secured a large part of the country.

**HAMILTON, ALEXANDER**, 1757–1804, one of the greatest of American statesmen. He was born on the island of Nevis, West Indies, on Jan. 11, 1757, and was probably the illegitimate son of James Hamilton,

a Scotchman, and Rachael Levine, a woman of Huguenot descent, who had separated from her husband, John Levine, a Dane. Alexander's mother died when he was a child, and he was cared for by her relatives at St. Croix, where he served in a counting house, and, having given evidence of exceptional intellectual capacity, he was sent (1772) to New York to be educated. He studied at a grammar school in Elizabethtown, N.J., entered Kings College,



MET. MUS. OF ART

**Alexander Hamilton**, from a painting by John Trumbull

now Columbia University, in 1773, and not only attracted attention as a student, but, remarkably mature mentally, took an influential part in the controversy between the colonists and the British government, ardently embracing the cause of the colonists.

**Revolutionary War.** Hamilton first attracted attention by an impromptu speech delivered before a mass meeting in New York on July 6, 1774. In opposition to the famous pamphlets signed "A Westchester Farmer," he wrote between Nov. 1774, and Jan. 1775, two pamphlets, *A Full Vindication of the Measures of the Congress from the Calumnies of Their Enemies*, and *The Farmer Refuted*, which had much influence and were astonishing coming from a boy of 18. "There are displayed in these papers," says George Tichnor Curtis, "a power of reasoning and sarcasm, a knowledge of the principles of government and of the English constitution, and a grasp of the merits of the whole controversy that would have done honor to any man at any age. . . . To say that they evince precocity of intellect gives no idea of their main characteristics. They show great maturity—a more remarkable maturity than has ever been exhibited by any other person, at so early an age, in the same department of thought." During the Revolutionary War he served with marked distinction in the Continental army, acting as an aide de camp, with the rank of lieutenant colonel, to General Washington (1777–

81) and leading one of the storming columns at Yorktown. In 1780 he married Elizabeth, daughter of Gen. Philip Schuyler.

**The Constitution.** Hamilton early saw the imperative need of a stronger central government and after the war, besides practicing law in New York, was a member of the Continental Congress (Nov. 1782–Aug. 1783), of the Annapolis Convention (1786), whose report recommending a general convention he drafted, and of the Constitutional Convention in Philadelphia (1787), before which he urged, with futile brilliancy, a degree of centralization which his fellow delegates were not prepared to accept. In the final result, however, his influence is unmistakably seen, and to him more than to any one else was due New York's ratification of the instrument as adopted; his influence being exerted both through the state convention, of which he was a member, and through a series of papers, later collected as *The Federalist* (to which Madison and Jay also contributed), which rank among the ablest political essays in the language. See **FEDERALIST PAPERS**.

**Federalist Leader.** Hamilton was a member of Congress (1787–88), and from 1789 to 1795, as the first United States secretary of the treasury, was the strongest constructive force in Washington's administrations. Besides organizing his department along general lines which have endured until today, he devised and recommended measures which established the public credit on a firm basis, and served to counteract the disintegrating tendencies among the states and to consolidate the union. The most important of these measures were those for funding the public debt, for the Federal assumption of state debts, incurred because of the war, and for the establishment of a national bank. His report (1790) *On Public Credit* is said to have "laid the cornerstone of American finance under the Constitution," and his report *On Manufactures*, has supplied with arguments many an advocate of the diversification of industries by government aid, though he cannot be said to have been a thoroughgoing protectionist as protectionism is now understood. In contending against Jefferson and others for the constitutionality of a national bank, he made the first effective use of an argument of far-reaching importance, that the Constitution by implication granted to the government all powers which were not specifically prohibited and which were necessary for the discharge of such powers as were specifically granted. This, the doctrine of "implied powers," later, in the decision of *McCulloch vs. Maryland* (1819), received the sanction of John Marshall and the United States Supreme Court. The imposition of an excise, recommended by Hamilton, brought on the "Whisky Rebellion," the quelling of which gave the central government a chance to demonstrate its power. In foreign as well as domestic affairs Hamilton's influence was felt; he counteracted the effusive zeal of the pro-French party, and advocated the ratification of the bitterly assailed Jay treaty with Great Britain. Politically, after parties had definitely formed, he was the leader of the Federalists, and as such came early into conflict with Jefferson, the Republican leader and, in many ways, his direct antithesis. He, however, quarreled with his party associate President John Adams, who, against his will, was forced, out of deference to Washington, to place him at the actual head of the army (nominally second to Washington), when war with France seemed imminent in 1798–1800. After Washington's death he was for several months nominally as well as actually the commanding general.

An indiscreet anti-Adams pamphlet written by Hamilton contributed to the defeat of the Federalists in 1800, and when Congress was called upon to decide between Jefferson and Burr, he put aside his animosity for Jefferson, and did much to secure his election. This intensified the hatred already felt for him by Burr, whom he had frequently and effectually



opposed, and Burr, on a trivial pretext, beguiled him into a duel (July 11, 1804) at Weehawken, N.J., opposite New York, and mortally wounded him at the first fire. Hamilton, who abhorred the prevalent code but felt forced to fight in order to preserve his influence, previously had determined to discharge his pistol into the air. He died the next day.

**American Statesman.** Hamilton was a great constructive statesman, a deviser of measures, a framer of policies, rather than distinctively a manager of men. Washington and Lincoln excepted, probably no man has rendered as great services to the nation. He was never popular as Jefferson was popular; he was a leader of the leaders of his party, rather than, directly, of the rank and file; he had few of the arts and probably little of the astuteness, tact, and skill of the popular political leader; he ardently admired the British form of government; he had little faith in the "masses," and did not believe that majorities were necessarily right. He saw the insistent need of national stability and unity, and, with Washington's support, originated and carried through the appropriate measures. Certain of his economic theories were opposed to those of later economists, but in general he was ahead of his time. See **JEFFERSON**, **THOMAS**; **TRUMBULL**, **JOHN**; **WASHINGTON**, **GEORGE** for illustrations. **H. L. H.**

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**HAMILTON, ANDREW**, c. 1676–1741, American lawyer, was born in Scotland. He was sometimes called Trent, and it is not definitely known that his right name was Hamilton. He came to Virginia about 1697; went to Philadelphia in 1716, became attorney general of Pennsylvania the next year and in 1721 a member of the provincial council, from which he resigned in 1724. From 1727 to 1739 he was in the Pennsylvania legislature. He became famous for his defense of the New York printer, Peter Zenger, who was arrested for libeling the government. Hamilton claimed that Zenger's statements were true, and therefore not libelous, and the jury returned a verdict of not guilty, thereby going far to establish the freedom of the press in America. Hamilton gave to Philadelphia the land now known as Independence Square, as a site for a legislative building.

**HAMILTON, ANTHONY, COUNT**, 1646?–1720, French author, a scion of the house of Abercorn, appeared as a captain of the French army in Limerick (1673), of which place he became governor (1685), and commanded the dragoons at the siege of Enniskillen. After the battle of the Boyne (1690) he retired to the exiled court of St. Germain-en-Laye, where he died. His ease and grace of style and thought are seen in his letters, verses, and *contes*. For his share in the *Mémoires de la Vie du Comte de Grammont*, see **GRAMONT**, **PHILIBERT DE**.

**HAMILTON, EMMA, LADY**, 1761?–1815, mistress of Lord Nelson, was christened Amy Lyon in Great Neston, Cheshire, England. As the mistress of the Hon. Charles Greville in London (1781–86), she studied the arts and posed for several charming Romney portraits. Greville sent her to Naples in 1786, on a visit to his uncle, Sir William Hamilton, ambassador from Great Britain. She accepted Hamilton's protection, and in 1791 became his wife. Lady Hamilton had a brilliant salon in Naples, and as the friend of Queen Maria Carolina was an unofficial English diplomat. She first met Nelson in 1793, and when he returned from his Nile victory in 1798 she devoted her attention to him. The Hamiltons and Nelson returned to England together in 1800, traveling across Europe, and in 1801 Lady Hamilton gave birth to Nelson's daughter, Horatia. She lived with Nelson at Merton Hall after Hamilton's death. Hamil-

ton and Nelson both left her annuities, but she was arrested for debt in 1813. She escaped on bail to Calais, where she died the next year.

**HAMILTON, Sir IAN STANDISH MONTEITH**, 1853–1947, British general, was born in Corfu. After a brilliant military career in the East and South Africa, he became a general in 1914. Appointed commander of the Mediterranean Expeditionary Force (1915), he was relieved of his command after an unfortunate attempt to land troops at Gallipoli in that year. His writings include *A Staff Officer's Scrap Book* (1906); *The Millenium?* (1918); *Gallipoli Diary* (1920); and *Listening for the Drums* (1944).

**HAMILTON, JAMES, 2nd LORD HAMILTON and 1st EARL OF ARRAN**, 1477?–1529, Scottish statesman, was the grandson of James II of Scotland on his mother's side. He was regent for James V from 1522 to 1524, yielding the regency to the Earl of Angus. He aided Angus in the conspiracy to hold the young king in custody, but became a royalist after Angus was exiled.

**HAMILTON, JAMES, 2nd EARL OF ARRAN**, d. 1575, Scottish statesman under Mary Stuart. On the death of James V in 1542, he was chosen as protector of Scotland during Mary Stuart's minority. Although he had earlier been a prominent Protestant, he became a Catholic and consented to Mary's marriage to the future Francis II of France. He gave up his regency in 1554 to Mary's mother, Mary of Guise, who had been his co-regent. After Francis II died, Hamilton tried futilely to arrange a marriage between Mary and his son James. He allied himself with the Protestant side again, and escaped from Scotland after Mary's marriage to Darnley. Returning in 1569, he was arrested by the Regent Moray, but was released after the latter's assassination. He supported the queen's party during the subsequent civil war, and was obliged to make terms with Morton in 1573. See **MARY QUEEN OF SCOTS**.

**HAMILTON, JAMES, 3rd MARQUIS and 1st DUKE OF HAMILTON**, 1606–49, Scottish statesman, succeeded to the family title in 1625. He was Charles I's chief adviser on Scottish affairs after 1634, and his commissioner to Scotland from 1638 to 1639. He was created duke of Hamilton in 1643. Numerous Hamilton intrigues caused Charles to have him arrested in 1644; he was set free two years later by Fairfax's troops. In 1648 he led Scottish troops into England to help the King, but was ignominiously defeated at Preston, taken prisoner, and beheaded.

**HAMILTON, JAMES**, 1786–1857, American legislator, was born in Charleston, S.C. He became a lawyer in his native city, served in the War of 1812, reaching the rank of major, was several times mayor of Charleston, and was elected to the state legislature. In 1820 he was sent to Congress as a States Rights Free Trader and he was three times re-elected. In 1830–32 he was governor of South Carolina. He supported the Nullification Act and was put in command of the state troops when measures were taken to resist the Federal government. Afterward he went to Texas, and in 1841 secured the recognition of that republic by England and France. He was engaged in successful negotiations to recover some of the money he had lent to Texas, when he was drowned when the ship on which he was traveling from Galveston to New Orleans collided with another and sank.

**HAMILTON, JOHN WILLIAM**, 1845–1934, American Methodist Episcopal bishop, was born in Weston, W.Va., studied at Mount Union College, and became a member of the Pittsburgh conference of the Methodist Episcopal church (1866), transferring to the New England conference two years later. Soon after receiving his degree from the Boston University School of Theology, he founded the People's Church in Boston and acted as its head from 1875 to 1884. Always progressively inclined, he sponsored the Hamilton Amendment (1892) which gained women admission to the general conference of the Methodist

## Hamilton

Episcopal church. In 1900 he was elected a bishop and appointed to San Francisco. He retired at the age of 71 to accept the chancellorship of the American University in Washington, D.C.

**HAMILTON, WILLIAM**, 1704–54, Scottish poet, was born in Bangour, Linlithgowshire. Joining the Jacobites in 1745, he escaped after Culloden to the Continent, but was afterward permitted to return to Scotland. He is the author of *Poems on Several Occasions*, but is remembered chiefly for his *Braes of Yarrow*.

**HAMILTON, Sir WILLIAM**, 1730–1803, British ambassador and antiquarian, was born in Scotland, served in the British footguards and as ensign in Holland, and was British ambassador at Naples (1764–1800). In 1791 he married Emma Lyon, who, as LADY HAMILTON, was the mistress of Lord NELSON. He acquired many Italian antiquities for the British Museum, and wrote *Antiquités Etrusques* (5 vols. 1766–67), *Observations on Mount Vesuvius* (1774), and *Campi Phlegroei* (3 vols. 1776–79).

**HAMILTON, Sir WILLIAM**, 1788–1856, Scottish philosopher, born in Glasgow. Educated at the universities of Glasgow and Oxford, he was admitted to the bar (1813); in 1821 he became professor of history at Edinburgh and later (1836) professor of logic and metaphysics. From 1829 he contributed articles to the *Edinburgh Review*; these were later published under the title *Discussions* (1852).

In his philosophy, Hamilton held that faith was a necessary supplement of reason, since the absolute is unknowable and the mind cannot conceive of either infinite space or time. His annotated edition of *The Works of Thomas Reid* was published in 1846, and his own philosophy was further developed and amplified by Mansel and Vetch, who edited and published two volumes of his lectures; *Metaphysics* (1859) and *Logic* (1861). According to his “doctrine of the conditioned,” to think of any object is to condition it since the thought necessarily relates it to the thinker and to other things. The conclusion is therefore drawn that knowledge can deal only with that which is conditioned and never with the absolute.

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**HAMILTON, Sir WILLIAM ROWAN**, 1805–65, Irish mathematician, was born in Dublin and studied at Trinity College, Dublin. As a child he had shown remarkable erudition, and in 1827, while still an undergraduate, he became a professor of astronomy in his university. Later he became astronomer royal for Ireland. By 1828, through the application of the algebraic method of co-ordinates, Hamilton completed his *Theory of Systems of Rays*, which with various supplements furnished a proof of the undulatory theory of light. The law of varying action and the laws of internal and external conical refraction which Hamilton formulated helped pave the way about a century later for MAX PLANCK’s quantum theory. Hamilton’s chief claim to distinction, however, is the invention of quaternions. This new system of algebra and geometry pertained to vectors and rotations in three-dimensional space and was constructed on a basis which disregarded the commutative law of multiplication (see QUATERNIONS).

BIBLIOG.—E. T. Bell, *Men of Mathematics* (1937).

**HAMILTON**, town, Australia, Victoria, Dundas and Normanby County, 198 miles W of Melbourne. Hamilton is the center of an agricultural and stock-raising district. During the season the race course attracts many visitors. There is a meat preserving factory. Pop. (1947) 7,181.

**HAMILTON**, seaport and capital of the Bermuda Islands, on the N side of Hamilton Bay, a deep cut into the W coast of Bermuda Island. The Bermuda Railroad connects Hamilton with Somerset and St. George’s, and ferries link it to Somerset and to Ireland Island. Hamilton’s sheltered harbor is the headquarters of most of the islands’ freight and pas-



BERMUDA TRADE DEVELOPMENT BD.

In Hamilton, Bermuda, bicycles and horse-drawn vehicles are still the most popular mode of travel

senger traffic. Much of the industry of Hamilton centers on the tourist trade. The city was founded in 1790. Pop. (1949 est.) 3,200.

**HAMILTON**, city, Ontario, county seat of Wentworth County, on Hamilton Harbor at the W end of Lake Ontario; the Canadian National, the Canadian Pacific, and the Toronto, Hamilton and Buffalo railways, and connections with several American railroads; about 70 miles NW of Buffalo. The city extends from the water front up the mountain, which is a part of the escarpment beginning in New York state and extending north to Georgian Bay. Hamilton is the hub of the provincial highway system and the connecting link with U.S. highways. Its landlocked harbor accommodates ocean-going vessels and is one of the finest on the Great Lakes. Although located in the Niagara fruit-growing district, Hamilton has developed as a manufacturing city because of the excellent rail, highway, and water transportation and the abundance of power. Water power is obtained from Decew Falls and Niagara Falls and gas from Wentworth County. Often called “the Pittsburgh of Canada,” Hamilton is the center of the steel industry of the Dominion. Among its other products are textiles, agricultural and textile machinery, typewriters, wire goods, elevators, tires and automobiles, tobacco, furniture, and shoes. Fruit from local orchards supplies large-scale canning operations. Many American industries have plants in Hamilton.

La Salle and his party of French explorers visited the site of Hamilton in 1669, charted the harbor, and surveyed the land. The first white settler was Robert Land, who arrived in 1778. The city was laid out by Loyalists in 1813 and named for George Hamilton,



CANADIAN NATIONAL RAILWAYS

View of Hamilton, Ontario, with industrial section along the harbor visible in the background



son of the Hon. Robert Hamilton from whose farm the village lots were made. In that same year, the settlement was successfully defended in the battle of Stoney Creek. The village became a town in 1833 and a city in 1846. Hamilton has an interesting historic home in Dundrun Castle, which is maintained as a museum of history. In the surrounding park, there are botanical gardens, a bird sanctuary, and a notable rock garden of rare plants. McMaster University was moved here in 1930, and there are also several technical schools and collegiate institutes. Pop. (1949 est.) 192,125. F. C. W.

**HAMILTON**, city, New Zealand, on North Island, in Auckland County, on the Waikato River, some 70 miles by rail SSE of the city of Auckland. It is the center of a dairying district. Pop. (1945) 26,344.

**HAMILTON**, a municipal burgh, S Scotland, Lanarkshire, situated near the junction of the Avon and Clyde rivers; 11 miles SE of Glasgow. Hamilton gives its name to the premier peer of Scotland, the Duke of Hamilton and Brandon (created in 1643). Hamilton Palace, a classical structure built in 1822, was razed in 1922 because of coal mining operations; the extensive grounds surrounding it were bought by the city for a pleasure ground. The Château of Châtelherault (built in 1732), and Cadzow Castle, built by Alexander I and now in ruins, are of interest. Cadzow stands on a lofty rock above the Avon, surrounded by the remains of the Caledonian oak forest. Other antiquities are Queenzie Neuk, a large Runic cross, and an old pillory from the time of Charles I. Bothwell Brig, where the Covenanters met defeat in 1679, is two miles north of the town. Industries include iron foundries, iron and coal mines, limestone quarries, and the manufacture of motor coaches, cotton goods, lace, embroidered muslins, black silk veils, and thread. Pop. (1950 est.) 40,600.

**HAMILTON**, city, SW Ohio, county seat of Butler County, on the Great Miami River; the Baltimore and Ohio, the Erie, and the Pennsylvania railroads, and U.S. Highway 127; about 25 miles N of Cincinnati. In 1791, while en route to the Northwest Territory, Gen. Arthur St. Clair built a stockade here on the east side of the river. A town was laid out in 1794 and named Fairfield. In 1796 Fort Hamilton was abandoned and in the same year the new settlement was renamed for Alexander Hamilton. Hamilton was the boyhood home of William Dean Howells, American novelist, editor, and critic. The chief manufactures include machinery, machine tools, Diesel engines, paper and fiber products, safes and vaults, and stoves. Pop. (1950) 57,951.

**HAMILTON**, in geology, a series of rocks laid down during the middle DEVONIAN and consisting of deposits of sandstones, shales, and limestones. The formation extends across New York, attaining a thickness of 1,500 feet in the center of the state, thence west to Iowa and Missouri and south to Tennessee. The formation reaches a maximum thickness of about 5,000 feet in Pennsylvania. Rocks of Hamilton age are also found in Canada in the Mackenzie River valley and in Manitoba.

**HAMILTON COLLEGE**. See COLLEGES.

**HAMILTON INLET**, a bay, Labrador coast, 150 miles long and 30 miles wide, the estuary of the Grand or Hamilton River. Its inner waters are Melville Lake.

**HAMILTON, MOUNT**, W central California, 25 miles E of San Jose. See LICK OBSERVATORY.

**HAMILTON RIVER**, formerly **Grand River**, Labrador, rises in Ashuanipi Lake in the interior and flows about 325 miles NE to the Atlantic Ocean. Soon after the river leaves the plateau it forms the spectacular Grand Falls and then flows in a deep narrow valley to Lake Melville (90 mi. long) and to **HAMILTON INLET**, one of the largest bays on the Labrador coast.

**HAMITIC LANGUAGES**. The Hamitic languages, which some scholars believe may be related

to the Semitic language family, include Egyptian, Berber, and Cushitic. While ancient Egyptian and its modern descendant, Coptic, are no longer spoken, the Berber and Cushitic languages are spoken by not fewer than nine million people in Africa today.

In the north and east of the Berber-speaking area, except where Kabyle is spoken, Zenetiya is the chief language. The Berber languages are spoken in the southern mountains and along the northern part of the east coast of Morocco as well as in eastern Algeria. Kabyle is spoken in the departments of Algeria and Constantine around Jurjura; Shawia is the language of much of southern Constantine. Tripolitan is spoken in southern Tunisia. There are some 300,000 speakers of Twareg in the Sahara desert and at various oases in the Libyan desert.

The Cushitic languages are spoken in the entire eastern corner of Africa from 4° South latitude in the north to between the Nile and the Red Sea in the south and in Ethiopia to the eastern foothills. The Agaw-Sidama languages form one Cushitic dialect group. Agaw is spoken in the Anseba river valley and surrounding mountains and to the south and east of Lake Tana. Sidama is spoken in the territory bounded on the north by the right bank of the Abbay and on the south by the borders of Lake Rodolph. The other Cushitic languages, spoken in Abyssinia and Somaliland, are Beja, Saho-Afar, Galla, and Somali.

THOMAS A. SEBEOK

**HAMLET**, town, S North Carolina, Richmond County; on the Seaboard Air Line Railroad and U.S. Highway 74, about 70 miles SE of Charlotte in an agricultural section. Hamlet is a railroad center and a market and shipping point for peaches and tobacco grown near by. Pop. (1950) 5,061.

**HAMLET**, a tragedy of revenge, SHAKESPEARE'S most famous play in modern times, was first produced about 1603, and was published complete in 1604. The earliest source of the story is a legend in the Latin history of Denmark by Saxo-Grammaticus (12th century). In the play, Hamlet, Prince of Denmark, moves slowly and irresolutely to avenge his father, murdered by an uncle who has married Hamlet's mother, the queen. Hamlet spurns the love of Ophelia, accidentally kills her father, Polonius, and is shipped off to England in a plot to destroy him. The plot failing, Hamlet returns to Denmark and conspires against his uncle. The king enlists Laertes, brother of Ophelia (who has drowned herself), to kill Hamlet in a fencing match, using a poisoned foil. In the match, the foils are switched and both Laertes and Hamlet are fatally wounded. In the excitement, the queen drinks poisoned wine intended for Hamlet, and Hamlet finally succeeds in stabbing the king.

**HAMLIN, HANNIBAL**, 1809-91, American statesman, was born in Paris Hill, Me. He was a member of the Maine legislature (1836-40, 1847), of the national House of Representatives (1843-47), and of the U.S. Senate (1848-57). Originally a staunch antislavery Democrat, he vigorously opposed in Congress all proslavery measures, and joined the Republican party soon after its organization. He became governor of Maine in 1857, but resigned the same year to re-enter the Senate; was vice-president of the United States during the Civil War (1861-65); again sat in the Senate (1869-81); and was minister to Spain (1881-83). See WILMOT PROVISIO.

**HAMLIN UNIVERSITY**. See COLLEGES.

**HAMM**, town, Germany, in the Prussian province of Westphalia, on the Lippe River and the Lippe Canal, 20 miles NE of Dortmund. The most important rail center in the Ruhr region, Hamm was repeatedly bombed by the Allies during World War II and suffered severe damage. Normally Hamm produces large quantities of iron, metal, and enamel wares, and chemicals. Other manufactures include gloves, starch, varnish and lacquer, and cotton wool. It has curative baths. Hamm was founded in 1226, joining the HANSEATIC LEAGUE in 1417. In 1614 it

came under Brandenburg. In World War II the town was taken by Allied forces in April 1945. Pop. (1956) 67,200.

**HAMMARSKJÖLD, DAG HJALMAR AGNE CARL**, 1905–, Swedish political economist and secretary general of the United Nations, was born in Jönköping. He held various posts in the Swedish government, was chairman of the Bank of Sweden, 1941–48, and in 1951 became deputy foreign minister and a member of the Swedish cabinet. In 1952 he headed the Swedish delegation to the UN General Assembly, and on Apr. 7, 1953, was elected UN secretary general. Subsequently Hammarskjöld won worldwide respect for his able and energetic efforts toward the peaceful settlement of problems involving China, Hungary, the Middle East, and Southeast Asia. In September 1957 he was elected to a second term.

**HAMMERFEST**, world's northernmost city and seaport, Norway, the capital of Finnmark County, 300 miles N of the Arctic Circle, at the very top of the Scandinavian Peninsula, on the Island of Kvalø, off the NW coast of Norway, 78 miles SW of North Cape. The climate is tempered by the Gulf Stream. Hammerfest has an excellent harbor; it shares in the Spitsbergen whale fisheries and is a headquarters for fishing and sealing fleets. At Cape Fuglenæs is the Meridian Column, a small granite monument crowned with a bronze globe, erected in 1852 as a memorial to the Russian, Norwegian, and Swedish geometers who measured the arc of the meridian



NORWEGIAN TRAVEL INFORMATION OFFICE

Harbor at Hammerfest as it appeared before the war (above) and after destruction in World War II

there. The sun does not set at Hammerfest from May to August nor appear from November 18 to February 1. Cod-liver oil is produced there in abundance. Furs, reindeer hides, eiderdown, and smoked and dried fish are exported. The Germans occupied Hammerfest in 1940, and toward the end of World War II their retreating armies completely destroyed the city. It was rebuilt after the war. Pop. (1955) 4697.

**HAMMERHEAD**, any shark of the genus *Sphyrna*, which inhabits all the warmer seas. The special peculiarity is that the head is broad, flattened, and expanded on each side into a process resembling the head of a hammer, on the flat terminal surface of which the eyes are placed. The great hammerhead (*S. zygoena*), which sometimes reaches a length of 16 feet, is occasionally seen in the North Atlantic.

**HAMMERSMITH**, metropolitan borough of W London, England, on the Thames, five miles W of St. Paul's; bounded on the E by Kensington and on the S by Fulham and the Thames. Here William Morris established his Kelmscott Press. St. Paul's School, founded in 1509, is one of the largest secondary day schools in England. Dove's Inn, where tradition says Thomson wrote part of his *Seasons*, is here. The section was bombed by the Germans during World War II because of its war industries, including lead and oil mills, motor works, coachbuilding factories, and boatbuilding yards. Pop. (1950 est.) 120,070.

**HAMMERSTEIN, OSCAR**, 1847–1919, American theatrical and operatic producer, was born in Berlin, Germany, and moved to the United States at 16. In 1870 he leased and managed the Stadt Theatre in New York, and in 1888 built the Harlem Opera House. He later built the Olympia, afterward known as the New York Theatre, the Belasco, and the Victoria, and in 1906 opened the Manhattan Opera House for the production of grand opera. He also built the Philadelphia Opera House in 1908 but sold it two years later. Financial difficulties arising because of competition with the Metropolitan Opera House caused him in 1910 to sell his interests, and in 1911 he went to London, where he became owner and manager of the new London opera house, Kingsway. This proving a failure, he returned to New York and made another attempt to establish a rival to the Metropolitan, but was obliged to abandon the project.

**HAMMERSTEIN, OSCAR II**, 1895–, American libretto and lyric writer, was born in New York City. Although a nephew of the famous Oscar Hammerstein, owner of the Manhattan Opera House, Hammerstein received his law degree from Columbia University and spent a year in a law office before turning to the theater. To gain a thorough grounding in his new profession he worked as a stagehand and later as a stage manager for the theatrical productions of his uncle, Arthur Hammerstein. *Wildflower* (1923) was the first hit show for which Hammerstein wrote the libretto. He followed it with such successful musical comedies



Oscar Hammerstein

and operettas as *Sunny* (1924), *Rose Marie* (1924), *The Desert Song* (1926), and *Showboat* (1927), for which he wrote such popular classics as "Ol' Man River," "Indian Love Call," "Who," and "One Alone." In 1943 he and Richard Rodgers composed *Oklahoma!*, winner of a Pulitzer committee special award, and first of a number of operettas—including *Carousel* (1945), *Allegro* (1947), *South Pacific* (winner of a Pulitzer prize for 1949), *The King and I* (1951), and *Flower Drum Song* (1958)—that were of a dramatic complexity rarely encountered in the musical play. Hammerstein's *Carmen Jones* (1943) is an adaptation of Bizet's *Carmen* to American idiom.



**HAMMETT, DASHIELL**, 1894– , American novelist, was born in Maryland and was educated at Baltimore Polytechnical Institute. Eight years of experience as a Pinkerton investigator supplied him with an intimate knowledge of crime detecting and the habits and psychology of criminals. He skillfully exploited this background in a series of detective novels which initiated a vogue of intense and brutal realism in this genre. His best known works are: *Red Harvest* (1929); *The Maltese Falcon* (1930); *The Thin Man* (1932); *Adventures of Sam Spade* (1945). In 1951 he was jailed for refusing to reveal the source of bail he had helped raise for four fugitive Communist leaders.

**HAMMOND, JAMES BARTLETT**, 1839–1913, American inventor, was born in Boston, Mass. He was graduated (1861) from the University of Vermont and from the Union Theological Seminary (1865), was a newspaper correspondent during the Civil War, and patented (1880) the "Hammond typewriter."

**HAMMOND, JAMES HENRY**, 1807–64, American statesman, was born in Newberry District, S.C., and studied at South Carolina College. Admitted to the South Carolina bar (1828), he practiced in Columbia and became an ardent supporter of nullification in the *Southern Times*, which he established in 1830. He served as governor of South Carolina (1842–44). In the U.S. Senate (1857–60) he upheld the doctrine of states' rights and the economic supremacy of the agricultural South where "cotton is king." He became known as "Mudsill Hammond" after a speech, in connection with the admission of Kansas, in which he maintained that the drudgery of life should be performed by a slave class constituting "the very mudsills of society."

**HAMMOND, JOHN HAYS**, 1855–1936, American mining engineer, was born in San Francisco. He was graduated from the Sheffield Scientific School of Yale in 1876, and studied at the Royal School of Mines in Freiberg, Germany. He served on the U.S. Geological Survey (1880), examining California gold fields, and was engaged in mining engineering in the West and South and in Mexico. He went to South Africa in 1893, and as a member of the Reform Committee was accused (1896) of implication in the



John H. Hammond

**JAMESON RAID** (with which, however, he was not in sympathy) and was sentenced to death by the Boers. He was released upon paying a fine of \$125,000. After his return to the United States he was associated with various mining properties and lectured at Columbia, Harvard, Johns Hopkins, and Yale universities. He was special ambassador to the coronation of King George V in 1911; president of the Panama-Pacific Exposition Committee to Europe in 1912; chairman of the World Court Congress in 1914–15, and chairman of the U.S. Coal Commission in 1922–23. He wrote an autobiography.

**HAMMOND**, city, NW Indiana, in Lake County, on the extreme S end of Lake Michigan and the Grand Calumet and the Little Calumet rivers; served by the Baltimore and Ohio, the Chesapeake and Ohio, the Chicago, Indianapolis, and Louisville, the Elgin, Joliet, and Eastern, the Wabash, the Erie, the Indiana Harbor Belt, the New York Central, the Nickel Plate, and the Pennsylvania railroads; and U.S. highways 6, 12, 20, and 41; about 20 miles SE of Chicago. Hammond is an important industrial city situated in the area around the foot of Lake Michigan known as the Calumet region. It was settled as a packing house town, in the early 1860's, by George H. Hammond, a Detroit butcher who originated the idea of refrigerating dressed beef for shipment. Known at first as State-

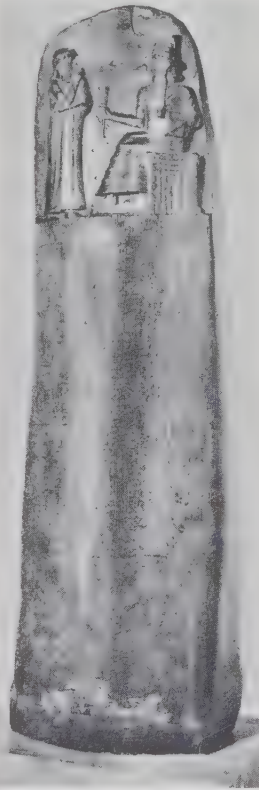
Line, the city's name was changed in 1873 to honor Hammond. South of the city is the 235-acre Wicker Memorial Park. The major industries of Hammond include printing and bookbinding and the manufacture of railroad, hospital, and surgical equipment, industrial and tire chains, forgings, castings, steel bars, corn sirup and allied products, soap and soap flakes, and metal toys. Pop. (1950) 87,594.

**HAMMOND**, city, SE Louisiana, in Tangipahoa Parish, on the Illinois Central Railroad and U.S. highways 51 and 190; about 45 miles E of Baton Rouge. Hammond is the "strawberry capital" of the United States. It was settled by Peter Hammond in the early part of the 18th century. The Southeastern Louisiana College is located here. Strawberry growing and shipping and the manufacture of strawberry crates are the principal industries of Hammond. Pop. (1950) 8,010.

**HAMMONTON**, town, SE New Jersey, in Atlantic County, on the Pennsylvania-Reading Seashore Railroad, 26 miles NW of Atlantic City. Hammonton, the center of a fruit-farming area, was settled in 1812 and incorporated in 1866. It was named for John Hammond Coffin, who owned an early glassworks here. Clothing, canned fruits and vegetables, cut glass, and wine are the principal manufactures. Pop. (1950) 8,411.

**HAMMURABI**, sixth king of the first dynasty of Babylon, ruled from 1729 to 1686 B.C. He is identified by Schrader with Amraphel, king of Shinar

(Gen. 14:1). By his victories over the neighboring states of Elam, Larsa, Sumer, Akkad, and especially Mari, on the middle Euphrates, he unified the Babylonian empire, but he seems to have devoted more time to building and construction than to warlike pursuits. In the winter of 1901–2, J. de Morgan discovered a large diorite stele on which were inscribed about 1690 B.C. a bas-relief of Hammurabi receiving laws from the sun-god and almost all of an inscription containing the code of these laws as promulgated by him. This stele is in the Louvre. A translation with transliteration was published in Paris by V. Scheil in 1902. The laws throw light upon the Babylonian social grades, industries, economic conditions, law and family life.



ORIENTAL INST.

Replica of Stele which set forth Code of Hammurabi

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**HAMPDEN**, JOHN, 1594–1643, English statesman, a cousin of Oliver Cromwell, was born probably in London. During the troubled years from 1625 to 1630 he resisted Charles I both in and out of Parliament, in which he sat for Wendover. He was much interested in American colonization, and may be regarded as one of the founders of Connecticut. His

opposition to the payment of ship money led to his trial (1637 and 1638) before the court of exchequer. Though judgment was given in favor of the crown, the feeling of the country expressed itself strongly on the side of Hampden, and the Long Parliament reversed the ship money judgment. In January, 1642, at the king's instigation, he was attacked in the House of Lords by the attorney general. When the civil war broke out, Hampden took an active part in raising troops for Parliament. He relieved Coventry in August, 1642, and took part in the subsequent siege of Reading. In a skirmish at Chalgrove Field in Oxfordshire, he was mortally wounded.

**HAMPDEN, WALTER**, 1879–1955, American actor, was born in Brooklyn, N.Y. He attended Harvard University (1896–97) and in 1900 was graduated from the Brooklyn Polytechnic Institute. His first stage appearance was in classical repertoire in London (1901), after which he was leading man at the Adelphi Theatre, London, for three seasons. In 1905 he succeeded the younger Irving in *Hamlet*. Two years later he returned to the United States, where he appeared in *The Servant in the House*, *The Yellow Jacket*, *Salome*, *Caliban*, *Cyrano de Bergerac*, and Shakespearean roles. In 1925 he leased the Colonial Theatre in New York, renamed it Hampden's and was actor-manager until 1930. His films included *Hunchback of Notre Dame* (1940) and *The Adventures of Mark Twain* (1944). In 1946 he returned to repertory with the American Repertory Theatre. In 1949 he appeared in *The Traitor* and *The Velvet Glove*.



Walter Hampden

**HAMPDEN-SYDNEY COLLEGE.** See COLLEGES.

**HAMPSHIRE**, or **Hants**, a maritime county of S England, divided into the mainland area of Southampton and the Isle of Wight; bounded on the W by Berkshire, on the E by Surrey and Sussex, on the S by the English Channel, and on the W by Dorset and Wiltshire; area 1,649 sq. mi.; pop. (1951) 1,292,211. The coast is broken by deep inlets such as Portsmouth Harbor, Southampton Water, and Christchurch and Pool bays. Spithead and the Solent Strait separate the Isle of Wight from the mainland. Rivers of the Southampton area are the AVON, STOUR, Test, Anton, Wey, Lympington, and Itchen. The North Downs stretch through the northwest and west of the county, rising to 1,000 feet in Walbury Down. In southwest Hampshire is New Forest; in the southeast are Bere Forest and Waltham Chase; in the east is Woolmer Forest. Agriculture is one of the chief industries of the county; crops include wheat, oats, barley, turnips, hops, and clover and other hay grasses. Bees are kept in all rural sections, providing quantities of honey for export. The famed Hampshire breed of sheep and thoroughbred horses are raised. Industries of the county include pottery and terracotta works, leather goods manufacture, fisheries, and ship- and yacht-building yards. SOUTHAMPTON, PORTSMOUTH, GOSPORT, and COWES (Isle of Wight) are the largest towns and ports; WINCHESTER is the county seat. Seaside resorts are BOURNEMOUTH, Milford, and Southsea. Aldershot is the principal military training center of Britain, and Sandhurst, a few miles north, has a famous military college.

The county has a wealth of antiquities, such as at Winchester, the ancient capital of Wessex, where an ancient castle claims the possession of Arthur's round table. Noteworthy also are the Netley, Beaulieu, and Quarr (on the Isle of Wight) abbeys; Carisbrooke, Porchester, and Merton castles; and the Pilgrim's Way, an ancient road which crosses the county west-

northeast to Kent and leads to the shrine of Thomas à Becket. With few exceptions every city of this shire, including those on the Isle of Wight, suffered severe bombing and damage throughout World War II, because of their naval and shipping bases, war industries, fuel and oil storage tanks, military training headquarters and R.A.F. airfields. See WIGHT, ISLE OF.

K. E. H.

**HAMPSTEAD**, metropolitan borough in NW London, England, bounded on the E by St. Pancras and on the S by St. Marybone. Old Hampstead is a residential district for artists and authors, where Keats, John Constable, Joanna Baillic, George Du Maurier, Dr. Johnson, Robert Louis Stevenson, Romney, Pope, and many other famous literary persons lived. Celebrated inns of the section are The Spaniards, Jack Straw's Castle, the Bull and Bush, and the Upper Flask, where the Kit Kat Club met. To the northeast lies Hampstead Heath, a resort having chalybeate springs. Pop (1951) 95,131.

**HAMPTON, WADE**, 1818–1902, American soldier, was born in Columbia, S.C., a grandson of Gen. Wade Hampton (1754–1835). Though opposed to secession, he joined the Confederate army, and raised a force called "Hampton's Legion," which he led with distinction at the first battle of Bull Run. He later took part in the battles of Seven Pines, Antietam, and Gettysburg, and during Sherman's advance from Savannah (1865) commanded the cavalry forming the Confederate rear guard. He attained the rank of lieutenant general, and was severely wounded three times. In 1876 he became governor of South Carolina, as the Democrats came back into power after the era of Reconstruction. He and the conservative Democrats virtually dominated the state until his defeat in 1890. He was U.S. senator from 1879 to 1891, and U.S. commissioner of Pacific railroads from 1893 to 1897.

**HAMPTON**, former urban district, England, in Middlesex on the Thames, 15 miles SW of London, since 1937 part of Twickenham municipal borough. Hampton Court Palace is located here.

**HAMPTON**, independent city, SE Virginia, county seat of Elizabeth City County, on the N shore of Hampton Roads at the mouth of the James River; on the Chesapeake and Ohio Railroad and U.S. Highway 60; about 82 miles SE of Richmond. The oldest settlement in continuous existence in the United States, Hampton was founded in 1610 by colonists from Jamestown on the site of an Indian village named Kecoughtan. It was represented in the first meeting of the Virginia House of Burgesses in 1619. Hampton was burned by the British during the War of 1812 and by its own inhabitants in 1861 to prevent its capture by Union troops. It is the seat of Hampton Institute, important center of Negro education. The Syms-Eaton Academy here is an amalgamation of two of the earliest schools in the United States. Fort Monroe, near by, is an historic U.S. Army post; Langley Field, to the north, a notable research and experimental station for aeronautics; and old Point Comfort, a resort, are in the vicinity. Hampton has important crab and oyster fisheries and manufactures of paint, brick, tile, boxes, and fertilizer. Pop. (1950) 5,966.

**HAMPTON COURT CONFERENCE**, a conference at Hampton Court, summoned by James I (1604) as a result of the Millenary Petition, presented by the Puritan clergy (1603), proposing changes in the prayer book which would not have been acceptable to the mass of the clergy, to the universities, or to a large number of laymen. With a few trifling exceptions, no concessions were made to the Puritans.

**HAMPTON COURT PALACE**, on the Thames, 15 miles southwest of London, was erected by Cardinal Wolsey in 1515, was presented by him to Henry VIII in 1526, and was in great part rebuilt from Wren's designs by William III. It was subsequently occupied by Mary, Elizabeth, Cromwell, the



Stuarts, William III, and the first two monarchs of the house of Hanover. Since the time of George II Hampton Court has ceased to be a royal residence, and is now occupied by pensioners of the crown, who live in 800 rooms of the palace. It contains a gallery of paintings, rich in Italian works of art. The garden, in the French style, is among the most magnificent of Europe. Across the highway from the garden is Bushy Park, famous for its hawthorn and chestnut trees.

**HAMPTON INSTITUTE.** See COLLEGES.

**HAMPTON ROADS,** channel connecting Chesapeake Bay and the James River, Virginia. It is an important U.S. Navy base. NORFOLK and PORTSMOUTH harbors are on the south; Hampton on the north. Fortress MONROE and Fort Wool defend the entrance.

**HAMPTON ROADS, BATTLE OF.** See MONITOR and MERRIMAC, BATTLE OF THE.

**HAMPTON ROADS CONFERENCE,** an informal conference held (Feb. 3, 1865) on board a vessel in Hampton Roads, near Fort Monroe, Va., between United States and Confederate representatives for considering means of bringing the Civil War to a close. The conference was first suggested and was arranged by Francis P. Blair, Sr.; President Lincoln and Secretary of State Seward represented the United States; A. H. Stephens, John A. Campbell, and R. M. T. Hunter, the Confederate states. President Lincoln offered liberal terms as the basis for a cessation of hostilities, but refused to recognize the Confederacy as an independent government or to modify the Emancipation Proclamation, and the conference came to nothing. See CIVIL WAR, AMERICAN.

**HAMSTER,** a burrowing rodent belonging to the family *Cricetidae*. Several species are known: the golden or Syrian hamster, *Cricetus auratus*; the European or black hamster, *C. cricetus*; a dwarf form, *Cricetulus*. The golden hamster, discovered in Aleppo, Syria, in 1930, and later introduced into the United States, is



ACME

Golden Hamsters are easily tamed.

the most popular. It has black markings on its head and cheeks, is usually reddish gold with a nearly white underside, has prominent black eyes, a stubby tail, and roomy cheek pouches for carrying food and nesting materials. Hamsters generally establish their homes near grain which they transport to grass- and leaf-lined nests deep within multichambered burrows. Golden hamsters are nearly odorless and easily tamed, factors making them desirable as pets. However, they may bite if annoyed. Their use as experimental animals, especially for vitamin assays and selected disease studies, is increasing. The animal's usefulness may be partially attributed to its small size (adults being five or six inches long), short gestation period (sixteen days), and prolificness. Hamsters will thrive and reproduce when kept in a clean, well-ventilated cage, amply supplied with food and water. Litters comprise six to thirteen offspring.

The black hamster, also found in Asia, is a stout-bodied animal about nine inches long with a three inch tail, reddish above and black below, with golden yellow patches on the head, sides, and shoulders. It has not been domesticated. See RODENT. M. R. K.

**HAMSUN, KNUT,** 1859–1952, Norwegian author, was born in Lom. While serving an apprenticeship as a cobbler, he began to write, publishing a poem and a short story in a newspaper. For a time thereafter, he became a wandering laborer, crushing stone on the road, cutting timber, often traveling on foot. He studied for a short while at the University of Christiania (Oslo), but found the atmosphere there uncongenial, and set out for America. While in the United States, he worked in the Dakota wheat fields and as a street car conductor in Chicago. Returning to Norway, he published *Intellectual Life of Modern America* (1889), a pessimistic appraisal of American cultural mores. *Hunger* (1890) initiated his career in the naturalistic novel, a genre in which he approached perfection in *Growth of the Soil* (1917), awarded the Nobel prize in 1920. Among his other works are *The Women at the Pump* (1928) and *Look Back Happiness* (1940). He was arrested as a collaborationist in 1945, but freed in 1946 because of old age. His conviction and fine in 1947 for writing pro-Nazi articles further diminished his prestige as a literary patriarch.

**HAMTRAMCK,** city, SE Michigan, in Wayne County, located within the confines of Detroit. It was named for Col. John Francis Hamtramck, the first American military commander of Detroit, and incorporated as a city in 1922. The Hamtramck Public School Code, a plan of education for immigrants, formulated here by Dr. Maurice R. Keyworth, has been copied widely by many other schools. The most important industry of the city is the manufacture of automobile bodies and parts. Eighty per cent of the population of Hamtramck, the state's 16th largest city, is of Polish origin. Pop. (1950) 43,355.

**HAN RIVER,** China, a tributary of the Yangtze River, which it joins at Hankow in Hupeh Province. Rising in southwest Shensi Province, the Han flows east and south through Hupeh, receiving the Jen, Tu, Tang, and Pai—the last two joining the Han at Siangyang, Hupeh Province. Because they are navigable almost to their sources, the Tan and Pai are main trade routes from Hankow to Siking and from Honan to Peiping. Following a tortuous course of 1,300 miles, the Han is navigable part of the year as far as Siangyang (300 mi.); small boats can come down from Nancheng (Hanchung), Shensi Province, near its source. At its mouth the river is only about 200 feet wide, but the bed soon widens to 400–500 feet and near Shayang in Hupeh Province, is a half mile wide. The channel shows a marked difference in depth at different seasons, varying from 20 to 90 feet. Navigation is dangerous during floods, because of shifting sands.

**HANAU,** town, Germany, in the Prussian province of Hesse-Nassau, at the confluence of the Kinzig and the Main rivers; 10 miles E of Frankfurt am Main. The newer portion of Hanau came into existence in 1597 through the efforts of the Reformed Dutch and Walloons. Its features of interest include the Dutch-Walloon Church established in 1599 and completed in 1608, the 16th-century St. John's Church, and the 18th-century town hall. Hanau's most important industry is the manufacture of jewelry, along with the related industry of diamond cutting. Other manufactures include machinery, leather and tobacco products, paper, and wood and quartz products. There is trade in wine, wood, and grain. Hanau became a town in 1303, and in the 16th and early 17th centuries refugee Reformed Dutch settled here. Here Napoleon defeated the combined Austrian and Bavarian armies under Wrede in October, 1813. Hanau was occupied by the French for a short time in the spring of 1920. Pop. 30,625.

**HANCHUNG.** See NANCHENG.

**HANCOCK, JOHN**, 1737–93, American statesman, was born in what is now Quincy, Mass. (then part of Braintree), and was graduated from Harvard in 1754. His father having died in 1744, he was adopted by an uncle, Thomas Hancock, whose fortune (unusually large for those days) and mercantile establishment he inherited in 1764. From 1766 to 1772 he was a member of the Massachusetts General Court, and in that body as well as outside, was one of the leaders of the opposition to the British; in 1774 and again in 1775 he presided over the extra-legal provincial congress of Massachusetts, and it was partly to apprehend him that the expedition of April 18–19, 1775, was sent from Boston to Lexington and Concord. General Gage excepted Hancock and Samuel Adams when he issued his proclamation of pardon to the colonists (June 12, 1775). Hancock was a member of the CONTINENTAL CONGRESS (1775–80 and 1785–86), was its president in May, 1775–Oct. 1777 (signing the DECLARATION OF INDEPENDENCE), and was again elected president in 1785, but on account of illness did not serve. He was also a member of the Massachusetts constitutional convention of 1780, and was the first governor of the state under the new constitution (1780–85), serving again as governor from 1787 until his death. In 1788 he was president of the convention called to consider the newly drafted Federal Constitution, and cast his influence on the side of adoption.



John Hancock

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**HANCOCK, WINFIELD SCOTT**, 1824–86, American soldier, born in Montgomery County, Pa. He graduated from West Point in 1844, and served in the Mexican War (1847–48). He was appointed brigadier general of volunteers at the outbreak of the Civil War, was promoted to major general in 1862, and distinguished himself as commander of the First Division of the II Corps at Antietam, Fredericksburg, and at Chancellorsville. At GETTYSBURG, where he commanded the II Corps, besides being largely responsible for the choice of that battlefield, he directed the left center on the second and third days (July 2 and 3, 1863) and repulsed the famous final assault of Pickett and Pettigrew, during which he was severely wounded. Resuming his command in March, 1864, he fought with his usual skill and brilliance in the battles of the Wilderness and Spottsylvania Court House, at Cold Harbor and at Petersburg. He was appointed brigadier general in the regular army (1864) and major general (1866), commanded for a time the Fifth Military district comprising Louisiana and Texas, his policy toward the defeated Southerners being liberal and conciliatory; and from 1872 until his death on Governor's Island, N.Y., he commanded the Division of the Atlantic. Nominated for the presidency as a Democrat, he was defeated by Garfield in 1880. He was one of the greatest, perhaps the greatest, of the Federal corps commanders.

S. W. X.

**HANCOCK**, city, NW Upper Michigan, in Houghton County, on Portage Lake opposite Houghton, on the Portage Lake ship canal, which connects Keweenaw Bay with Lake Superior, on the Copper Range and the Mineral Range railroads and U.S. Highway 41; about 100 miles NW of Marquette. Hancock is situated in a rich copper mining country and a popular resort area. It was first permanently settled in 1859. In 1903 it was incorporated as a city and named

for John Hancock, the statesman. Hancock is the seat of the Suomi College and Theological Seminary, a Finnish Lutheran institution. Copper mining and smelting are the major industries of the community. The manufacture of dairy products is also important. Pop. (1950) 5,223.

**HAND.** See SKELETON; HANDEDNESS.

**HANDBALL**, a wall game, basically similar to rackets and squash rackets but differing from them in that the player's hand—not a racket—is used to hit the ball. Handball is usually played by two persons. The court is about 60 feet long, and 25 feet wide, with side and front walls 30 feet high. A line, called the ace line, is marked on the floor parallel to the front wall and 30 feet from it. A solid rubber ball is used.

The server stands on the ace line and drops the ball to the floor and, on the rebound, bats the ball with his palm against the front wall, causing it to rebound back of the ace line. His opponent, standing in the rear court, endeavors to bat the ball back against the wall while it is in the air or on the first bounce. The play continues until the server's opponent fails to make a return, whereupon the server is credited with one point or ace. The player serving continues until he fails to make a return, whereupon his opponent wins the service and continues to hold it until he loses the point. The player whose score first totals 21 points or aces wins the game. The game may be played as doubles.

HARRY BEARDSLEY

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**HANDECK FALLS.** See WATERFALLS.

**HANDEDNESS**, or **DEXTRALITY**, is the individual's preference for one hand rather than the other. This seems to be related to the dominance of the cerebral hemisphere opposite the preferred hand. Higher functions, such as speech, are also controlled by the dominant cerebral hemisphere. Association areas are more developed in the dominant hemisphere. This specialization of one half of the brain as related to handedness, thought, and language obviously exists only in man.

Since most individuals are right-handed, the social environment must be oriented around this hand. The left-handed individual faces many special problems. One of these is reversing postural directions in learning skills. However, forcing a child to change handedness not only subjects him to strain in muscular adjustment, but also produces continual nervous strain. Disapproval or disappointment on the part of parents may develop awkwardness and stuttering, often leading to feelings of inferiority and peculiarity. Disadvantages due to left-handedness may be overcome by special instruction and the use of special equipment, such, for example, as is provided for "southpaw" baseball players.

M. CONELL

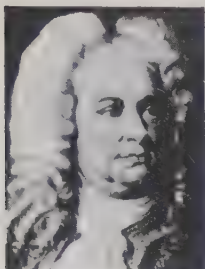
**Ambidexterity.** In spite of the fact that human beings are basically and obviously bilateral, they do not operate in a plane of symmetry. Man always reacts angularly as it were. Monolateral preferences—whether in the eyes, feet, or hands—are thus the result of development. Perfect ambidexterity (i.e., equal preference for either side) is considered an anomaly. Ambidextrous individuals are often found to have a congenital unilateral (one-sided) lesion of the speech area in the brain. Where this is found, retraining of speech habits depends on degree of involvement of the speech center or adjacent pathways.

M. H. KROUT

**HANDEL, GEORGE FREDERICK**, 1685–1759, German-English composer, was born in Halle, Saxony, in the same year as his great contemporary, Johann Sebastian Bach, though the two were destined never to meet. Handel's father was a barber-surgeon who at the age of 62 had remarried. George Frederick was the second son of this second marriage. In spite of his father's opposition, he learned to



play the clavier, practicing secretly in the attic on an instrument smuggled in by a sympathetic friend. Fate next took a hand, with the further help of the boy's stubborn persistence, a trait he retained throughout his life. When he had been refused permission to go along on a visit to an older step-brother who was valet at the court of the Duke of Saxe-Weissenfels, young George, aged 7, followed the coach on foot until his father was forced to relent.



George F. Handel

Once at the court, he gained access to the chapel organ and one day was overheard practicing by the duke, who was much impressed. A reprimand to the boy's father for not encouraging such gifts resulted in his being put under the tutelage of Zachau, organist of Halle cathedral, who taught him counterpoint, composition, violin, oboe, and the various keyboard instruments. This thorough training lasted for three years, during which time, as an exercise, he wrote a sacred motet every week. He also became assistant organist to his teacher, who finally confessed he could teach him nothing more. About 1696 he made a visit to Berlin where his extraordinary improvisations won him the admiration of the court and awakened the jealousy of another composer, Buononcini. The elector, desiring to attach Handel to his service, offered to send him to Italy to study, but the offer was declined. Handel's father still looked upon music as an idle pursuit and wished his son to be a lawyer. In truth, the post of court musician in Germany at that time was not always an enviable one either, so Handel returned to Halle. The next year his father died, and when his other studies were completed, he dutifully entered upon the study of law, serving also as cathedral organist to support himself and his mother.

In 1703, however, he went to Hamburg to play violin in the opera orchestra, succeeding to the directorship after filling that place at the harpsichord in an emergency. Here he formed important friendships with the composers Telemann and Mattheson. With the latter he once went to Lubeck to try for the position of organist left vacant by the retirement of the great Buxtehude. Both refused to compete when they learned that the winner was expected to marry the former organist's elderly daughter. Handel never did marry; in fact, there is no evidence that he ever fell deeply in love.

**First Operas.** While in Hamburg, Handel wrote *Almira*, the first of his many operas, an example of the mixture of German and Italian languages and styles typical of the time and place. It was first performed in 1705, and was followed by several others in similar vein. However, Italy beckoned, and with money he had earned he visited Florence, Venice, Rome, and Naples as his own master. He stayed three years, producing sacred music and two new operas which were performed in Florence and Venice with great success. He made the acquaintance of such famous composers as Corelli and the two Scarlattis, whose smoother Italian styles exercised a lasting and beneficial influence on Handel's own.

As a result of his spreading fame, Handel was offered the post of Kapellmeister to the elector of Hanover (afterward George I of England), which Handel accepted on condition that he first be granted leave of absence to visit England whence he had received pressing invitations. There he journeyed in 1710 and achieved a great success with his new opera *Rinaldo*, composed in two weeks. It should be pointed out that composing a "new" opera meant to composers of that day often fitting melodies they had previously used to a new libretto, and there is a famous

instance of that practice in this opera, the aria "Lascia ch'io Pianga."

**Work in England.** Handel was bound to return to Hanover, but he did not stay there long. In 1712 he returned to England, again on leave, and this time he chose to forget his promise until 1714 when, to his embarrassment, the elector, succeeding to the English throne on the sudden death of Queen Anne, came to London too. The story goes that, to appease the monarch, Handel wrote a set of 25 pieces now known as the *Water Music*, to be performed at a royal aquatic fete on the Thames River, and that the king was so pleased by the music that Handel was restored to favor. The carnival, however, did not take place until 1717, and Handel was in the king's good graces before that, having accompanied him on a trip to Hanover the year before, where he composed an oratorio, *The Passion*, his last work with a German text.

On his return to England, he became chapel master to the Duke of Chandos, in whose service he composed his first English oratorio *Esther* and a set of Te Deums and anthems. He also taught the Prince of Wales' daughters, for whom he wrote numerous clavier pieces, including the *Harmonious Blacksmith* variations.

In 1720 he undertook to direct the operas at the Haymarket Theater for the Royal Academy of Music, opening with a highly successful performance of his own *Radamisto*.

**Loss of Popularity and Its Restoration.** In the years that followed he turned out opera after opera, in spite of factional disputes and difficulties led by Buononcini, the composer whose jealousy had been awakened years before in Berlin. Handel came off victorious in a spectacular competition, but by his outspoken bluntness, he alienated many of the nobility, so that after 1730 his works met with less success. The desertion of many of his singers and friends led to his bankruptcy in 1737 and the failure of his health. Seeing the futility of persisting in opera, he turned gradually, after the age of 50, to the oratorio, in which field he did his greatest work, beginning with *Saul and Israel in Egypt*. In 1741 he was invited to Dublin and while there, wrote his immortal *Messiah*, first heard in 1742. This was followed by *Samson*, *Judas Maccabeus*, *Joshua*, and many others, *Jephthah* (1752) being his last. Though his popularity returned, he continued to have financial troubles, in all of which he scrupulously worked to pay his debts. By 1750 he was again prosperous, but soon his sight began to fail. Though he underwent three unsuccessful operations for cataract, he continued to perform in public, accompanying his oratorios on the organ, it is said, until eight days before his death.

Though Handel wrote much for harpsichord and numerous organ concerti, sonatas, suites, and concerti grossi, the massive grandeur of his harmony, the simple beauty of his melody, the clarity of his contrapuntal writing are all shown at their best in his oratorios. Add to this the fact that they are the exalted expression of a noble mind and a deeply spiritual nature, and the worth of these highest manifestations of his genius is apparent. Handel is unquestionably one of the great masters. See MUSIC, Germany; OPERA; ORATORIO.

IRWIN FISCHER

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**HANDICAPPED.** Any bodily defect that is a disadvantage in normal activities is considered a physical handicap. Public attention has caused programs for the welfare of the handicapped to be concentrated on the more noticeable handicaps: loss of hearing, vision, or parts of the body, and crippling of the bones, joints, and muscles (orthopedic handicaps). There is a growing realization that other disabilities which seriously affect the individual deserve consideration: damage to the heart, veins or kidneys; difficulties with the nervous system such as cerebral palsy, ataxia, multiple sclerosis and epilepsy; respiratory ail-

## Handicapped

ments, including arrested tuberculosis, silicosis and asthma; diabetes; hernia; and speech defects.

The exact number of the physically handicapped is not known, but estimates have been made that are based on health examinations of certain groups such as school children. Government agencies have estimated that there are some 28,000,000 persons in the United States with some type of physical impairment, of whom 4,000,000 have a permanent physical handicap. Each year 800,000 additional persons are seriously impaired. According to recent estimates, some 1,200,000 older children and adults need special job training and placement because of handicaps. There are possibly 6,000,000 handicapped children in the country, including 3,500,000 with speech defects, some 750,000 with impaired hearing, another 750,000 with orthopedic disabilities, 500,000 with heart damage, and



ILL. DIVISION OF REHABILITATION

### Handicapped war veteran holds responsible job

for work and placement in a job suited to the abilities of the individual, recreation and counseling to help the individual with his personal problems. Contrary to popular opinion, experience in employing the handicapped during the war has shown that with careful placement in a suitable job, the handicapped person can be just as efficient as other workers and often has fewer absences and changes jobs less frequently. Education of the public in understanding the needs and abilities of the handicapped is a vital necessity in securing support for such programs.

**Education.** Certain handicapped children, for example the blind, the deaf and those with severe orthopedic crippling, need special equipment and specially trained teachers in order to have as good an education as other children. The present trend is to enable these children to have a normal homelife with their parents and contacts with unhandicapped children while having special training in the public schools. In most states, state funds aid the local schools with the extra expense of educating handicapped children. However, these advantages are available as yet only in the larger cities and many handicapped children in small towns or rural areas have no education or are only partly educated. All states provide boarding school care for blind and deaf children. It is known now that the training of blind and deaf children should be started in early infancy if they are to take advantage of schooling and in some localities there are classes for parents and public and private nursery schools for these children. Some schools provide job training for handicapped children and counseling to advise them concerning suitable occupations.

**Public Programs.** Throughout the history of the United States there has been a trend toward increased public responsibility for the health of the population and for financial aid and other services for the handicapped. Public programs naturally vary in extent and effectiveness in various localities. Local, state and Federal health departments have programs for improved sanitation, the prevention and treatment of contagious diseases, the health care of prospective mothers and of children, and teaching the public methods of maintaining good health. Local, state and federal departments of education promote special education for handicapped children and in some areas there are periodic health examinations for school children to discover handicaps and conditions that lead to crippling. The National School Lunch Act of 1946 was designed to improve the nutrition of 10 million school children and thereby prevent illness that might lead to permanent handicaps. Public laws of varying effectiveness in different localities enforce accident prevention in industry and make the employer responsible for medical care and financial compensation for industrial accidents and diseases. Through the Social Security Act of 1935 (and amendments) the Federal government provides funds and advice to the states for public health programs, maternal and child health, aid to the permanently and totally disabled, and services to crippled children. The latter consists of locating crippled children, providing diagnosis



CHICAGO BOARD OF EDUCATION

### Exercises aid in correcting defective speech

300,000 epileptics. There is an unknown number of persons with more than one handicap.

**Causes.** Physical handicaps are usually due to accidents, diseases, birth injuries, and defects in the development of the child before birth, but the causes of some handicaps are not yet known.

Rheumatic fever, which damages the heart, tuberculosis of the bones, which causes bone deformities, and infantile paralysis, which results in inability to use muscles, are common causes today of crippling in children. Yet it has been maintained that with full use of modern medical knowledge, a very large percentage of all handicaps could be prevented.

The situation of the handicapped is improving in that the numbers of persons with certain types of handicaps have decreased in recent years because of improved nutrition, prevention of disease and accidents, and better medical and obstetrical care. Many existing physical handicaps can be improved through physical therapy, surgery and other medical treatment, but there are many areas in the United States where such treatment is not available to everyone. In the case of handicaps due to illnesses that tend to recur, such as rheumatic fever and tuberculosis, proper health care can help to prevent additional damage. Research is being done by public and private agencies and by individuals in the prevention and treatment of physical handicaps.

An ideal program for the physically handicapped, toward which both public and private agencies are working, consists in making available to all handicapped persons means of restoring as much use of their bodies as possible, helping them to develop their native abilities, and enabling them to lead happy, normal lives as self-supporting, self-respecting members of the community. Such a program must include medical diagnosis and treatment, providing appliances such as hearing aids and artificial limbs, special public education for handicapped children, training



and treatment with convalescent care and home nursing, furnishing appliances and giving social service. This act also enables the Federal government to pay for part of the support of blind persons. The blind have received other special benefits from the Federal government: free books printed in Braille type that can be read by the blind; phonographs and talking book records on which all sorts of books are recorded; and additional exemption from the income tax because of the higher living expenses of the blind. Federal laws provide for the government purchase of necessary equipment made in workshops for the blind, for setting up vending stands operated by the blind in public buildings and for guide dogs for blind veterans. Public Law 16 provides vocational counseling, training and placement for handicapped veterans through the Veterans' Administration. Since 1920 the Federal government has made some provision for vocational rehabilitation for all handicapped persons. This program was greatly extended by Public Law 113 in 1943 so that the states receive Federal financial help in furnishing handicapped adults with medical diagnosis and treatment, appliances, vocational guidance and testing, maintenance and equipment during job training, tuition for job training, job placement, and treatment for those who have emotional problems. As a result, many thousands of disabled persons have become self-supporting, productive citizens who, in many cases, paid back in income taxes more than the government funds that had been spent on their rehabilitation. Federal departments also are active in research on health problems, education and vocational rehabilitation of the handicapped and consult with state officials to help them develop and improve programs for the handicapped.

**Assisting Organizations.** There are thousands of voluntary organizations throughout the United States that serve the handicapped by aiding individuals, educating the public in understanding the needs of the handicapped, and promoting better legislation and public programs for the handicapped. Many of these organizations are local branches of national organizations such as the American Health Association, the American Social Hygiene Association, the American Society for the Prevention of Blindness, the National Association of Goodwill Industries, the National Foundation for Infantile Paralysis, the National Tuberculosis Association and many others. There are about 500 privately operated workshops that employ the blind and are united into the National Industries for the Blind under the leadership of the American Foundation for the Blind.

In order that every handicapped person may receive the service that he needs, experts in this field recommend co-ordination of the efforts of the voluntary organizations and public agencies and extension of the excellent services now available in large cities to small towns and rural areas. See *BLINDNESS, Education and Rehabilitation*; *DEAF AND HARD OF HEARING*; *CHILD WELFARE*; *PHYSICAL THERAPY*; *VOCATIONAL REHABILITATION*; *INFANTILE PARALYSIS*, NATIONAL FOUNDATION FOR.

MARY STATHAM

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**HANDÖL FALLS.** See *WATERFALLS*.

**HANSEL**, an ancient ceremonial mode of binding a bargain or other legal transaction by the clasp of hands. Though the practice survives both in Europe and America, it has everywhere lost its legal efficacy. The term is still sometimes applied to the giving of *EARNEST*, and sometimes to a part payment made to bind a bargain. In Scotland it is used popularly to describe the first transaction (as a purchase or sale) of the day or week, and more generally to gifts made on the first Monday of the new year—hence called *Hansel Monday*.

**HANDSWORTH**, town, England, NW suburb of BIRMINGHAM, called "Britain's Pittsburgh" because of its extensive ironworks. It underwent savage raids by German flyers from November, 1940, to June, 1941. Pop. (1931) 72,622.

**HANDWRITING AND HANDWRITING ANALYSIS.** Interest in handwriting dates back to earliest antiquity. The first published record attempting to deal with handwriting as a method of investigating personality and character goes back to Camillo Baldi, who in 1622 began the analysis of handwriting into its elements. When Baldi's work was revived by the French school of Abbe Michon and Crepieux Jamin, the attempt to relate specific elements in handwriting to personality characteristics was carried on and led to the development of the school of "isolated signs." Side by side with this development there grew up the intuitive interpretation of handwriting, based upon the total impression made by the entire script. Among those who engaged in this practice were the Chinese philosophers of the 11th century and the European and American poets and artists of the 19th century: Goethe, Poe, Brown, Scott, etc. From these two streams flowed later attempts at the scientific investigation of the significance of handwriting.

It is generally agreed that the handwriting of a given individual is unique. Whether this uniqueness of handwriting is a reflection of deeper underlying personality characteristics or is simply a result of specific habit formation having no further connection with the personality is still a debatable question. Far more is now known about the technique for identifying the writer of a given handwriting specimen than about the technique for inferring personality traits from handwriting characteristics. The problem of the handwriting expert who attempts to identify the author of a given script is a double one: (1) convincing himself of the authenticity of the handwriting specimen, and (2) presenting the evidence in a manner that will convince the judge and jury. Sometimes the authenticity of the writing itself is not of great moment but the condition under which it was written is significant. In many instances it is important to determine whether the writer's hand was pushed or guided, or whether alterations were introduced after the completion of the document. The first step in such investigations is to find a genuine sample of the author's handwriting with which to compare the sample under analysis.

The scientific handwriting expert works under the assumption that a certain amount of variability in the handwriting is to be expected, and his primary purpose is to determine whether the observed variation is within the expected limits. Many ingenious devices for investigating specimens of writing have been developed. These include microscopic examination of the paper texture and ink to determine whether the writing at the creases preceded or followed the creasing, chemical and physical examination of the paper and the ink itself, etc. Regarding the expected variation in handwriting, such characteristics as tremors, types of final stroke for ending words and other characteristics of the handwriting are utilized for identification purposes. For the most part, however, scientific handwriting experts limit themselves to the scientific aspects of the identification problem and usually do not make any use of the psychological interpretations of the particular elements which they observed.

The art of drawing inferences about the personality of a writer from an examination of his handwriting is known as graphology or handwriting analysis. In the past there have been two approaches in this field. The first might be described as the intuitive global approach in which the expert utilized his intuition and imagination in examining the specimen, and emerged with an evaluation which, though it was often penetrating and impressive, did not permit even the

analyst himself a glimpse of the methods used in arriving at the conclusion. On the other hand, the school of "isolated signs," previously mentioned, sought to relate specific elements in handwriting to corresponding personality traits. Beginning with the recognition that handwriting was an expressive movement belonging in the same category as facial expression, vocal expression, gait, etc., these early graphologists made attempts to combine intuitive insights with a more objective understanding of the particular movement which produced a given script.

By removing the stress formerly placed on the appearance of the script itself, and placing it on the movement which produced the script, graphologists found it possible to isolate the underlying factors which explain a given writing performance. Thus the handwriting characteristics themselves might be divided into the three spatial vectors of height, width and depth of stroke, corresponding to the vertical, horizontal and depth dimensions of physical space. The depth dimension which indicates the degree of pressure exerted in the writer's movement cannot be measured directly but can be inferred from such characteristics as the width of the stroke produced by the spreading of the nibs of the penpoint under pressure and the ridges in the back of the paper on which the script was written. The general form of writing, degree of ornamentation, types of connecting forms used, etc., do not as such lend themselves to direct measurement, but they can be rated on a rating scale.

In an attempt to find some common denominator which would provide a frame of reference for the varying aspects of handwriting, both metric and non-metric, the rhythm hypothesis of the German psychologist, Klages, may be worth considering. Klages has shown that the degree of rhythm exhibited by a given handwriting is a good measure of the wholeness of the personality, since healthy people, according to Klages, express themselves rhythmically in all their expressive movements.

In order to test Klages' hypothesis, a system for classifying degrees of rhythm was proposed by Lewinson and Zubin. First the intuitive evaluation of the total handwriting sample was replaced by a minute analysis of individual letters and parts of letters, and each of these elements was measured or rated on specific scales. These scales were developed on the assumption that all handwriting measures reflect the rhythm between contraction and release tendencies in the muscular movements of the writer. This common denominator underlying all measurements permitted the classification of lengths, widths and angles as well as ratings on such factors as degree of ornamentation which could not be placed on a metric scale.

In general, the assumption underlying this system begins with the axiom that for a given cultural group the handwriting instruction begins with identical letterforms in the school copy, and any deviation from the original school copy tends to indicate the particular pattern of contraction and release which characterizes a given individual. This in turn may be related to personality traits.

In attempting to apply these scales to normal individuals and mental patients, Lewinson and Zubin found that the handwriting of normal individuals was characterized by a definite degree of contraction or release which was for the most part measurable and relatively constant. On the other hand, the handwriting specimens of mental patients were too variable to permit any single contraction tendency or even combination of contraction and release tendencies to describe it. Apparently one of the outstanding characteristics of mental patients' handwriting specimens is the rather high degree of variability which they present.

Some broad claims have been made for the usefulness of graphology in diagnosing diseases. Liver ailments, cardiac and gastrointestinal diseases, cancer,

tuberculosis, accident-proneness, and nearly all psychiatric categories have been mentioned as conditions in which handwriting may prove to be a diagnostic feature. It is difficult to evaluate these claims, because too often the data on which they are based lack sufficient scientific control. Careful comparisons of group data of epileptics, schizophrenics, and manic-depressives have indicated that the handwriting of these individuals differs significantly from the handwriting of normals. Such data, however, are differentiated on a group basis only, and do not yield sufficient information for individual diagnosis. One of the advantages of graphology is the fact that handwriting records can be obtained at various stages in the development of an individual. Thus the premorbid handwriting is very often found to be quite different from the morbid handwriting in such diseases as schizophrenia and similar conditions. This gives the investigator an opportunity to trace the onset and development of the disease process.

In summary it may be said that although the claims of graphologists have not been proved in general, some of their claims seem to have at least a modicum of validity. Only with the provision of more reliable and more valid measuring devices will it become possible to give the final verdict on the usefulness of graphology as a scientific discipline. JOSEPH ZUBIN

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**HANDY, THOMAS TROY**, 1892–, American army officer, was born in Spring City, Tenn., and studied at Virginia Military Institute. Commissioned a lieutenant of field artillery, he served in France in World War I. He was assigned to the war plans division of the War Department General Staff (1936–40); commanded the 78th Field Artillery Battalion (1940–42); was deputy chief of staff of Army Ground Forces (March–May 1942), assistant chief of staff, War Department (1942), and deputy chief of staff, U.S. Army (1944). With General Marshall and Admiral Leahy, he directed much of the army's operations in World War II. In August, 1949, he assumed command of U.S. occupation forces in Germany.

**HANDY, WILLIAM CHRISTOPHER**, 1873–, American "blues" composer and music publisher of Negro lineage, was born in Florence, Ala. He was called the father of the "blues" because he was first to crystallize Negro folk laments into "blues songs." His playing of his composition *Mr. Crump* in a political campaign launched his fame, and the piece was renamed *Memphis Blues*. He composed the *St. Louis Blues*, *Mississippi Blues*, and *Beale Street Blues*. His autobiography, *Father of the Blues* (1941), was edited by Arna Bontemps.

**HANFORD**, city, central California, county seat of Kings County, on the Southern Pacific and the Santa Fe railroads; 30 miles S of Fresno. It is a trading center for ranchers. Industries include a milk condensery, oil refinery, flour and planing mills, meat and poultry packing plants, and canned and dried fruit plants. Pop. (1950) 10,028.

**HANFORD**, precinct, Washington, Benton County, on the Columbia River near Yakima. A giant plutonium plant was erected here for experiments in atomic energy during World War II. See **ATOMIC BOMB**.

**HANGAR**, a structure in which aircraft are housed, either for shelter or for maintenance or repair. The size and type of construction of a hangar are determined largely by the purpose for which it is intended and the aircraft for which it is designed. Small aircraft, which are relatively vulnerable to weather hazards and which are not used regularly, are almost always kept in hangars when the craft are not being flown. Most medium and large-sized aircraft are built to stand nearly all types of weather, however. The chief purpose of hangars for these air craft is to afford





OFFICIAL U.S. NAVY PHOTO

**U.S. Navy airship hangar at Lakehurst, N.J.**

protection for men and equipment engaged in repair, maintenance, or servicing activities that can best be carried on under cover. The rest of the time the aircraft stand outside. This does not apply to lighter-than-air craft—blimps and dirigibles. These are more affected by the weather than airplanes, especially by wind, and hence are usually kept in hangars.

**Hangars for Small Airplanes** can be built out of many materials, including masonry, galvanized steel, adobe, wood framing, or steel framing. The last two may be covered with varied types of materials, frequently fireproofed. One of the most common small-airplane hangars is the "T" type, the wings fitting in the cross-bar of the "T" and the fuselage in the narrow base. Multiple-plane hangars may be of many shapes; sometimes they consist of nested "T" hangars. Because of the fire hazard, it is not desirable to house more than four to six privately owned and operated aircraft in one structure. Aircraft operated or stored by a commercial flying service are usually kept in barn or garage-like structures and tilted nose-downward so many can be stored together in small space.

**Hangars for Large Airplanes** are today usually only servicing centers around which are arranged stockrooms, shops, quarters for servicing and inspecting personnel and equipment, operating offices, and other facilities. There are two main types; large hangars in which a variety of aircraft can be serviced in portable maintenance docks; and hangars equipped with fixed docks. The latter are frequently installed where there are enough airplanes of one type in service to justify specialized services. The single-stall hangars used in fixed-dock maintenance may be arranged in groups with community fire walls. They do not need the wide spans necessary for the larger, portable-dock hangars. Both types, however, must provide large, unbroken spaces, and hence pose intricate and costly construction problems. Both arch and cantilever construction is utilized, and either steel or reinforced concrete as the material. Some hangars have spans as great as 340 feet.

**Airship Hangars.** Some of the largest hangars ever built were designed for the giant dirigibles used between the World Wars. Among them is the great U.S. Navy hangar at Lakehurst, N.J., 803 feet long, 264 feet wide, and 190 feet high, and designed to shelter two airships side by side. The doors are in pairs, sliding open both ways from the center. Like the side walls they are of asbestos and steel and each



AMERICAN AIRLINES, INC.

**DC-4's in hangar at LaGuardia Airport, N.Y.**

door weighs 800 tons. They are mounted on wheeled trucks, similar to those in use on railroad cars, and travel on a railroad laid laterally across the front of the building. Lengthwise upon the floor of the hangar and extending 1,500 feet beyond it at both ends are sections of railroad to which the airship was attached when it was to be run into the hangar. H. L. H.

**HANGCHOW**, city, E central China, capital of Chekiang Province, located near the mouth of the Fuchun (Tsien Tang) River, which empties into the East China Sea via Hangchow Bay. It is one of China's most historic and commercially important ports, with broad streets, modern buildings, ancient Buddhist temples and pagodas, the greater part built in wooded hills and on the shores of Western (Si-Hu) Lake. Marco Polo, who visited it in 1285, mentions it in his travels as one of the world's finest and most beautiful cities. It was the home of the National Chekiang University until it moved inland in 1927. As capital of one of China's premier silk-producing



EWING GALLOWAY

**Homes on shore of Western Lake in Hangchow**

provinces, it has been headquarters for an important silk weaving industry through many dynasties. The GRAND CANAL, built in A.D. 600 to carry rice from the Yangtze plain to Peking (Peiping), starts here. As a railway and highway terminus it is linked with Nanking, Shanghai, and Nanchang. Exports are products of the silk industry, embroideries, gold and silver objects of art, and tea. Hangchow was made a treaty port after the Sino-Japanese war of 1895. In December, 1937, it was captured by Japanese troops, who held it until September, 1945. The city suffered much damage during the latter half of World War II, but 72 of the 150 factories had resumed operation by 1947. Pop. (1945) 485,042.

**HANGING**, a method of executing capital punishment in Western Europe and America. In England it prevailed from the 13th century, and in the United States from the first execution in the colonies, its

out obtaining nourishment at the cost of their host. In this respect they differ from parasites, with which they are often confused. The vast majority of epiphytes belong to tropical rain forests of the lowland hot type or to the cooler, moist cloud forests of the mountains. In such places they luxuriantly cover stems, branches, and frequently even the leaves of trees, often forming veritable hanging gardens.

J. A. STEYERMARK

**HANGÖ**, Finnish **Hanko**, seaport and resort, occupying the SW tip of Finland; on the peninsula of Hangöudd (Hankoniemi), in the Gulf of Finland, 85 miles W of Helsinki. Its port is fortified. The chief exports include fish, butter, wood pulp, and paper; the imports are iron ore, coal, wool, and flour. Here in 1714 a Russian fleet defeated a Swedish fleet. In April, 1918, German troops landed in Hangö to aid the separatist (anti-Bolshevist) movement in Finland. By the terms of the Soviet-Finnish treaty in March, 1940, the Soviet Union was given the right to establish a military and naval base at Hangö. Upon the conclusion of the second war between the two countries in September, 1944, the Soviet Union waived its rights to Hangö for a similar naval base in the Porkkala area near Helsinki. Pop. (1948 est.) 6,500, mostly Swedes.

**HANKOW**, or **Siakow**, largest inland port of central China, in the province of Hupeh, on the left bank of the Han River at its junction with the Yangtze Kiang. Across the Han River to the west lies the city of HANYANG and across the Yangtze Kiang, WUCHANG, the capital of Hupeh; together with Hankow these are known as the Wuhan Cities. Hankow's position at the junction of important waterways and its central position in relation to the two basins of the Tung Ting and the Poyang lakes make it the commercial metropolis of central China. Ocean steamers go up the Yangtze Kiang 600 miles from Shanghai to Hankow; from there big river boats go 800 miles west to Chungking, and smaller boats navigate the Han River up to Hanchung in Shensi, connecting the northwestern with the central provinces. One railway line leads from Hankow to Peiping in the north and another from Wuchang to Changsha and Canton in the south. Both lines were at least partly in Japanese hands during World War II. An extensive junk traffic also connects Hankow with many smaller places. Therefore it has always been the main entrepôt for Hunan, Hupeh, and—next to Chungking—for Szechwan. This was especially true after Hankow had become a treaty port, which made it also a banking center.

The chief exports are tea, raw silk, hides, hemp, beans and bean cakes, cotton and cotton fabrics, kerosene, hardware, and sugar. Hankow's foreign trade steadily increased until the beginning of the Chinese-Japanese War in 1937, with a temporary interruption in 1926-27. The main industrialization of the Wuhan Cities started in 1891 with the building of the Han-yang Iron and Steel Works which, 17 years later, fell under the control of Japanese capital. Spinning,

#### Business section of Hankow before World War II

BURTON HOLMES-EWING GALLOWAY



Reconstruction of Hanging Gardens of Babylon

comparative humanity having caused it to replace other and more barbarous methods of enforcing the death penalty. In the United States 23 states and the District of Columbia have electrocution; 7 states have hanging; 11 states execute by lethal gas; 1 state (Utah) gives choice of hanging or shooting; and 7 have life imprisonment and no death penalty. The method of execution used by the Federal government is that employed by the state where the sentence is imposed. See CAPITAL PUNISHMENT.

**HANGING GARDENS.** Man-made hanging gardens were made famous by those of Babylon, constructed by NEBUCHADNEZZAR (604-561 B.C.) but ascribed to Semiramis. These gardens, five in number, are included among the SEVEN WONDERS OF THE WORLD. Each possessed an artificial mound 400 feet square, the sides of which were partitioned with earth terraces set on stone platforms. These earth slopes were laid out with groves, avenues, and formal beds of flowers, and provided with galleries and banquet rooms. The whole structure was irrigated from a reservoir at the summit that was filled with water raised from the Euphrates River.

In nature hanging gardens occur throughout the world, especially in the forests of tropical and subtropical regions where rainfall and temperature are favorable for the growth of plants called EPIPHYTES. Such plants germinate on other plants and grow with-





weaving, and cotton cloth factories—some of them also producing silk and brocade—dye works, and rice mills are mainly concentrated in Wuchang. The waterworks and the electric power house as well as most of the wood and tung oil refineries, flour mills, tobacco, tea, soap, albumen and match factories, cement works, and distilleries are in Hankow.

**History.** The district of the Wuhan Cities, of which Hankow is the youngest but largest, has been known in Chinese history under various names, and several temples and pagodas commemorate some of the historical spots. Part of Kingchow, later the Chu Province under the Chou Dynasty (1122–255 B.C.), it gained great importance during the period of the Three Kingdoms (A.D. 221–265), when Wuchang became the capital of the Kingdom of Wu. Wuchang was known as Aochow in the Tang Dynasty (618–905) and was the governmental center of Hwukang, a region embracing the modern provinces of Kwangtung, Kwangsi, Hunan, and Hupeh during the Yuan Dynasty (1206–1341) and Hunan and Hupeh only during the Ming Period (1368–1628). Now Wuchang is still the provincial capital of Hupeh.

Hankow did not acquire real importance until it became one of the four garrison towns of the empire and later was opened to foreign trade. British, Russian, German, French, and Japanese concessions were successively established in the second half of the 19th century, forming a sharp contrast, with their modern buildings and wide streets, to the narrow native district. The German and Russian concessions were returned to China after World War I; the British settlement was taken back in 1927, and the Japanese in 1937. The French settlement was returned to the Chinese government in 1946. The Wuhan Cities have gained great political importance since 1911, when the revolution started there. During many desperate fights between the imperial and revolutionary armies some districts of the city were destroyed. Others had been burnt down during the Taiping Rebellion, 1849–64. In 1927, after the national armies had moved in from the south, a Chinese municipality was set up in the British concession, preceded by serious mob attacks on the concession. For some months, the Wuhan Cities were the seat of the newly formed government, which soon moved to NANKING.

In December, 1937, after the fall of Nanking, Hankow became China's wartime capital. It served as the base of Chinese resistance until it fell to the Japanese on Oct. 25, 1938. Already badly damaged by Japanese bombings, most of the Wuhan Cities' industries were destroyed by the retreating Chinese in accordance with their "scorched earth" policy. Some industrial equipment was moved to Szechwan, especially that from the Hanyang arsenal and the iron and steelworks. Toward the end of World War II the Wuhan Cities suffered again, this time through American and Chinese bombings of Japanese military centers. During the war mass evacuations of the civilian population occurred. In the Chinese civil war, Nationalist forces withdrew from Hankow before the advancing Communist armies in May, 1949. Pop. (1947) 722,000.

**HILDE KIANG**  
**HANLEY**, one of the pottery making federation of towns of STOKE-ON-TRENT, England, in Staffordshire.

**HANNA, MARCUS ALONZO**, known as **Mark**, 1837–1904, American political leader, was born in New Lisbon (now Lisbon), Ohio, and was educated in the common schools of Cleveland and at Western Reserve University. He entered his father's wholesale grocery house in Cleveland, and continued in that business from his father's death in 1862 until 1867, when he formed a partnership with his father-in-law, Daniel P. Rhodes, and his sons, under the name of Rhodes and Co., which soon established a coal and iron business. Ten years later the firm name was changed to M. A. Hanna and Co., and began to develop a lake-carrying business. Hanna became president of the Union National Bank of Cleveland and of

the Cleveland City Railway Company, and in 1885 was appointed by President Cleveland a director of the Union Pacific Railway Company. In 1880 he began his active political career as a Republican worker in Cleveland, and in 1884, 1888, and 1896 was a delegate to the Republican national conventions. In 1896 he was elected chairman of the Republican National Committee and became a political figure of national importance by reason of his part in the nomination and election of WILLIAM MCKINLEY. Governor Bushnell of Ohio appointed him to the U.S. Senate (1897) to fill the vacancy caused by the resignation of John Sherman, and at the next session of the Ohio legislature he was elected to the same position for the full term. Though he was not conspicuous in Washington, he was known to have great influence with the McKinley administration. He publicly identified himself with the National Civic Federation shortly after its organization in 1900, and in 1901, having been elected chairman of the executive committee, was largely influential in the settlement of the anthracite coal strike.

**HANNAH**, the mother of the prophet SAMUEL. Her song (I Sam. 2:1–10) is by many critics believed to date from a later time.

**HANNEGAN, ROBERT EMMETT**, 1903–1949, American political leader, was born in St. Louis, Mo.; studied law at St. Louis University, and practiced in his native city (1925–42). As member (from 1933) and chairman (1934–35, 1936–42) of the City Central Commission of St. Louis, he was a prominent Democrat. President Roosevelt appointed him collector of internal revenue for the Eastern District of Missouri (1942–43) and promoted him to commissioner of internal revenue at Washington, D.C. (1943). Hannegan was national chairman of the Democratic party (1944–47) and U.S. postmaster general (1945–47). He owned a controlling interest in the St. Louis Cardinals (1947–49), but sold it before his death.

**HANNIBAL**, 247–183 B.C., Carthaginian general, and one of the greatest military geniuses of antiquity, was the son of Hamilcar Barca (see HAMILCAR). When he left Carthage for Spain with his father in 238 B.C., the latter made him swear undying hostility to the Roman name, and he faithfully kept his oath. After his father's death (228) he served in Spain under his brother-in-law, HASDRUBAL; and when Hasdrubal was murdered (221), Hannibal was called to the chief command. After spending two years in securing his base in Spain and training his troops, he attacked and, after a siege of eight months, took Saguntum, with the deliberate intention of provoking war with Rome.

**Italian Campaign.** With about 90,000 infantry, 12,000 cavalry, and 37 elephants, Hannibal left New Carthage about the beginning of May, 218 B.C., and crossing the Pyrenees lost 20,000 men. One of the most disputed questions of ancient history is that of the pass by which Hannibal crossed the Alps; on the whole, probabilities point to the road by Mont Genève, or the Col de l'Argentière. In any case, he suffered serious losses, only 20,000 of his foot soldiers and 6,000 of his mounted troops surviving to reach Italy. The Roman general, SCIPIO, who had come north to meet the invaders, was defeated in a skirmish near the river Ticinus, and soon afterward near the Trebia, when he lost 20,000 men (about December, 218 B.C.). After a short rest, Hannibal crossed the Apennines and the marshes of the Arno with great suffering, he himself losing an eye from ophthalmia. He entrapped the Roman consul FLAMINIUS into an ambush at the Trasimene Lake, inflicting upon him a crushing defeat, and then marched south into Apulia, and into Campania.

In the next year (216), after wintering in Apulia, Hannibal gained a great victory at Cannae, in which probably at least 50,000 of the Roman army of 80,000 fell, and 20,000 were taken prisoners. It has often been said that had he at this time advanced against Rome he would have taken the city and ended the

## Hannibal

war; but facts are against this view. The reward of his victory was the accession of the Lucanians, Brutians, most of the Samnites, and Capua, where he wintered. The luxury of that city is popularly supposed to have proved the ruin of his troops; but it was not Capua that ruined Hannibal—it was rather the resolution of Rome, and the fact that he could no longer entice her generals to decisive battles. In 212 he captured the town of Tarentum; but he failed to raise the siege of Capua, which fell in 211, though he made a sudden march to the gates of Rome.

**End of the War.** In 207 came the crisis of the war. Hannibal's brother Hasdrubal invaded Italy from Spain, but before he could join Hannibal he was met by the Roman consuls Livius and CLAUDIUS at the river Metaurus and decisively defeated; his army was practically annihilated, and he himself perished. For four years more Hannibal maintained his position in Bruttium; but finally the successes of the younger Scipio in Spain and his invasion of Africa called him home. He sailed from Croton in the autumn of 203 B.C., having for 15 years held his own in Italy without a single serious defeat. But in 202 he fought the decisive battle of Zama in Africa against Scipio, and was utterly defeated, and at once urged his country to make peace.

During the next few years Hannibal labored for the restoration of his country, reforming the government and reorganizing the finances. In 195 B.C., however, Rome demanded his surrender, and to avoid that he took refuge with ANTIOCHUS THE GREAT of Syria, who in 192 B.C. engaged in war with Rome. Hannibal's last appearance in war was in command of a fleet, which the Rhodians defeated off Aspendus in 191 B.C. Then the submission of Antiochus forced him to seek a new protector, and he fled to Prusias, king of Bithynia, with whom he lived, until the Romans sent Flaminius to demand his surrender. Thereupon Hannibal, seeing that escape was impossible, took poison (183 B.C.).

Hannibal displayed all the qualities of the highest military genius—breadth of strategy, untiring energy, and rapidity of action, and consummate handling of his troops upon the field. His private character has been much maligned by Roman historians; but an impartial view seems to disprove their charges of treachery and barbarity. See *CARTHAGE; PUNIC WARS; ROME, Early History of Rome*. R. W. M.

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**HANNIBAL**, city, NE Missouri, Marion County, on the Mississippi River, the Wabash and the Burlington railroads, and U.S. highways 36 and 61; about 98 miles NW of St. Louis. Founded in 1819, Hannibal owes its growth to river trade during the years between 1830 and 1870. When shipping by flatboats declined, the city developed industrially and now bases its prosperity on railroad shops and factories producing shoes, cement, machinery, and metal furniture. The city maintains the Mark Twain Museum and his boyhood home as a memorial to Samuel L. Clemens (Mark Twain) who, with his family, moved here in 1839. Hannibal is the setting for Mark Twain's famous Huckleberry Finn and Tom Sawyer. Pop. (1950) 20,444.

**HANNO**, fl. c. 480 B.C., a Carthaginian navigator who went on a voyage of discovery and reached the west coast of Africa, where he founded several towns. On his return he published an account of his voyage which was translated into English by Falconer in 1797.

**HANNO THE GREAT**, fl. third century B.C., a Carthaginian leader who opposed Hamilcar and



PAUL'S PHOTOS

### Crowds of shoppers at Central Market at Hanoi

Hannibal and eventually became leader of the party favorable to Rome.

**HANOI**, city, NE French Indochina, state of Vietnam, capital of North Vietnam (formerly Tonkin), on the Red River, about 50 miles WNW of Haiphong, the port on the Gulf of Tonkin. Hanoi lies near the 21st north parallel, and its summer climate is hot and humid; in winter overcoats are often necessary. Two railways give access to China; a northwest route into Yunnan, and a northeast route into Kwangsi. Since 1892 the old Annamese town has been rebuilt on a plan similar to that of Washington, D.C. There are French and native quarters, a business section, and a military area containing a fortress. Hanoi is the seat of a Roman Catholic bishop. The cathedral, the palace of the former French governor general, the Temple of the Great Buddha, the citadel, and the botanical and zoological gardens are also of interest. Hanoi was the capital of French Indochina from 1902 until the end of World War II. It was under Japanese occupation from 1940 until 1945, and for the next year it was the capital of the Republic of Vietnam under the Vietminh. Pop. (1951) 217,000, including 4,500 French and 11,000 Chinese.

**HANOVER**, a former province of Prussia, NW Germany, since 1946 part of Lower Saxony, stretching from the Netherlands E to the Elbe, and from the North Sea S to Hesse-Nassau, including the former duchy of East Friesland, the Lüneburg Heath (55 mi. long), part of the Harz Mountains, and outliers of the Weser Mountains (400 to 1,700 ft.); area 14,976 sq. mi.; pop. (1939) 3,537,000. The soil beside the rivers (Elbe, Weser, Ems, Aller, and Leine) is fertile; the greater part of the area, however, is moorlands, large areas of which have been drained and reclaimed. Cattle are bred and grazed on the marshes next the North Sea. One-sixth of the area is covered with forest. Coal, iron, zinc, lead, copper, and salt are mined in the HARZ MOUNTAINS and elsewhere. Iron-ware and steel goods, textiles, sugar, machinery, gutta-percha and India rubber, chemicals, scientific instruments, beer, and spirits are the most important industrial products. The chief cities are HANOVER, OSNABRÜCK, GÖTTINGEN, and HILDESHEIM. Göttingen has a famous university, founded in 1737. In 1692 the Duke of Brunswick-Lüneburg was made an elector of the empire, and his domain became known as the electorate of Hanover. In 1714 Elector George Louis ascended the English throne as GEORGE I, and until 1837 Hanover and Great Britain were under a personal union. Hanover became a kingdom in 1815, but in 1866 after it had sided with Austria in the Austro-Prussian War it was annexed by Prussia and made a province of this kingdom. After World War II Hanover came under British occupation. In 1946 it became part of the new state of Lower Saxony.

**HANOVER**, German **Hannover**, city, N central Germany, capital of the state of Lower Saxony, on the Leine River, about 150 miles W of Berlin. The MITTELLAND CANAL, connecting the Rhine with the Elbe, touches the outskirts of the city. Hanover was



## Hanover

an important railway center and a flourishing industrial town before World War II. The principal manufactures included machinery, railroad freight cars, rubber, iron, stationery, chemicals, automobiles, matches, pianos, chocolate and candies, cigarettes, sausages, canned meat, and textiles. Among features of interest in the city are the Royal Palace (the so-called *Leine-Schloss*), which survived the war; the new city hall, partly destroyed in World War II; the Market Church, erected in 1435 and restored and enlarged in the 19th century; the beautiful house of the philosopher Leibniz, partly destroyed; the Museum, still standing; the Welf Castle, built in Romanesque style in 1857-66 and harboring the Institute of Technology, very badly damaged; the theater, now an empty shell; and Herrenhausen Castle, the summer residence of the former Hanover kings, begun in 1665 with beautiful gardens modeled after those of Versailles. Sir William Herschel, the astronomer, was born in Hanover, and the philosopher Leibniz died here. Hanover, first mentioned in 1163, joined the Hanseatic League in 1386. In 1866 the city, together with the rest of the state, was annexed by Prussia. The greater part of Hanover was destroyed by British air raids in the summer of 1944, during World War II. Pop. (1950) 441,615.

**HANOVER**, town, W New Hampshire, in Grafton County, near the Connecticut River, on the Boston and Maine Railroad and U.S. Highway 5; about 50 miles NW of Concord. The village of Hanover is the seat of DARTMOUTH COLLEGE. Pop. (1950) 6,259, including 4,999 in village.

**HANOVER**, borough, S Pennsylvania, in York County, on the Pennsylvania and the Western Maryland railroads, 18 miles SW of York. Hanover is an industrial center surrounded by the rich fields of Conewago Valley. It was founded about 1764 by German settlers and named for the city in Germany. The first Civil War battle north of the Mason-Dixon line was fought here on June 30, 1863. Shoes, wire cloth, furniture, wall paper, cigars, twine, and water wheels are made in Hanover. Pop. (1950) 14,048.

**HANOVER**, township, E Pennsylvania, in Luzerne County in an anthracite mining region near Wilkes-Barre. Pop. (1950) 15,051.

**HANOVER**, village, Virginia, county seat of Hanover County, on the Chesapeake and Ohio Railroad; 18 miles N of Richmond. Here, May 27, 1862, Gen. Fitz-John Porter, with a part of the Army of the Potomac, drove from the field a Confederate brigade, under General Branch, with a loss of 265. The Federal loss was 355.

**HANOVER COLLEGE.** See COLLEGES.

**HANOVER, HOUSE OF**, English royal house whose right to the throne was established by the Act of Settlement of 1701. In accordance with this act the crown was settled on Sophia, princess of Hanover, granddaughter of James I. In 1707 the union of England and Scotland under the name Great Britain took place. This measure, which was necessitated by the omission of Scotland from the Act of Settlement, provided that the Protestant heirs of Princess Sophia of Hanover should succeed to the crown of the United Kingdom. The first Hanoverian king of Great Britain was GEORGE I, son of Sophia, who ruled from 1714 to 1727. Subsequent Hanoverian monarchs were George II, George III, George IV, and William IV. The ascension of Victoria to the throne and her subsequent marriage to Albert ended the Hanover reign.

**HANSEATIC LEAGUE**, an association of North German trading towns, which in one form or another existed from the 12th to the 16th century. The word *hansa* implies an association or guild, and usually means a merchants' guild. The Hanseatic League was a league of towns chiefly for the purpose of trade, though with this political objects were sometimes associated, as in Bergen and Wisby. The Baltic and the North Sea had early become important highways of commerce, and in the 13th century Wisby, on the



U.S. ARMY SIGNAL CORPS

### Remains of Hanover, Germany, after World War II

island of Gothland, had grown into a flourishing town with a considerable eastern trade. Before the end of that century, however, Lübeck, Rostock, Wismar, Stralsund, Greifswald, and Danzig had begun to play a prominent part in the trade of the Baltic. On the North Sea, Bergen, London, and Bruges were the principal foreign markets frequented by German traders; in the first of these they monopolized the entire trade of Norway. In the west, Cologne was the rival of Wisby; but her supremacy was early threatened by Lübeck, Hamburg, and Bremen.

In 1266 and 1267 Lübeck and Hamburg led in organizing German merchants in England into a single Hansa. But before the middle of the 14th century the Baltic and North Sea traders were united into one general league, the trading colonies of which extended from Novgorod the Great in Russia westward to London. Although not a strict confederacy, the league soon began to acquire political power. Lübeck came to be the headquarters and center of its activity.

For many years Denmark was the only serious maritime rival confronting the league and eventually the aggressions and ambition of Waldemar IV (1340-75) forced it into a war with Denmark. The traders proved the stronger, and in 1370 the treaty of Stralsund subjected Denmark to the domination of the league. In 1375 the Emperor Charles IV spoke of Lübeck as one of the five chief towns of the empire. In the 15th century the power and influence of the Hanseatic League began to decline and by the end of Henry VII's reign the English were making their rivalry felt in Norway as well as in the Baltic. At the same time, the importance of the western towns of the league increased, while that of the Baltic towns declined. The growth of territorialism in Germany, combined with foreign competition, and the geographical discoveries of the age, broke up the Hanseatic League, but Lübeck, Hamburg, Bremen, and a few others, have still retained the name of Hanse towns. See TRADE ROUTES, OCEAN; TRADE AND COMMERCE; GUILD; TARIFF.

**HÄNSEL UND GRETEL**, an opera in three acts by ENGELBERT HUMPERDINCK. The libretto by his sister, Adelheid Wette, was based on Grimm's fairy tale. First produced at the Hoftheatre, Weimar, Dec. 23, 1893, it was performed in the United States, in English, at Daly's Theater, New York, Oct. 8, 1895. *Hänsel und Gretel* melodic themes are drawn from folk tunes and it is the most successful of Humperdinck's operas. A change from the realism of Mascagni's operas, its popularity was widespread from its first performance.

**The Story.** Hänsel and Gretel, the children of a poor broom-maker, are interspersing the weary labor of tying brooms with a little dancing when their mother comes home. In her anger at them for idling she tips over a pitcher of milk, the only food in the house besides dry crusts. Furiously she sends the youngsters into the woods to pick strawberries for supper. Shortly after they go, their father comes home,

drunk as usual, but carrying a basketful of food, having had a day of successful broom-selling. He is shocked to hear that the children are in the woods, for he has heard that there is a cruel witch living there. The parents run out to look for the pair.

Meanwhile Hänsel and Gretel have wandered deep into the forest and have filled their basket to the brim with strawberries. They sit down on a grassy hill to rest and begin eating a few of the berries. Before they know it the basket is empty again and night is falling. Frightened, they huddle together knowing that they cannot find their way home in the darkness. The sandman strolls by filling their eyes with sand and the pair fall asleep, guarded by the 14 angels their prayers have invoked.

In the morning they awake to find themselves beside a quaint cottage completely made of candy and cake. The hungry children begin to nibble the delicious house and do not see the witch until she puts a noose around Hänsel's neck. Swiftly the witch pushes the two into her house and locks Hänsel into a cage, intending to fatten him before baking him into a gingerbread boy in the oven. However, she considers Gretel plump enough for baking and slyly asks her to look in the oven to see if the honey cakes are done. Gretel pretends she does not know how to do it and asks the witch to show her. When the old woman bends down to the oven, Gretel pushes her in and locks the door. She frees her brother and together they lift the spell on all the children that had been turned into a gingerbread fence around the house. When their parents arrive, Hänsel and Gretel open the oven to take the witch out. She has been baked into a huge mound of gingerbread.

M. R.

**HANSEN, ALVIN HARVEY**, 1887–, American economist. A prominent American disciple of JOHN MAYNARD KEYNES. Hansen was born in Viborg, S.D., and studied at Yankton College and at the University of Wisconsin. After teaching economics at Wisconsin, Brown, and Minnesota universities, Hansen became Littauer professor of political economy at Harvard University in 1937. During the years 1933–34 he served as economist for the U.S. State Department, and from 1945 has been an economic consultant for the Federal Reserve Board. Noted for applications of Keynesian economics in Monetary Reform and Business Cycle Theory, his many books include: *Cycles of Prosperity and Depression* (1921); *Economic Stabilization in An Unbalanced World* (1932); *Full Recovery or Stagnation* (1938); *Fiscal Policy and Business Cycles* (1941); *America's Role in the World Economy* (1945); *Monetary Theory and Fiscal Policy* (1948).

**HANSEN, GERHARD ARMAUER**, 1841–1912, Norwegian scientist, was born in Bergen, Norway. He discovered the leprosy bacillus (1879) and developed many treatments and improved techniques for stamping out the disease while physician and director of the Nursing School for Lepers in Bergen. Because of the unsavory connotations of the ancient word *leprosy*, the U.S. Public Health Service has urged the use of the term *Hansen's disease*.

**HANSEN, MARCUS LEE**, 1892–1938, American sociologist, was born in Neenah, Wis., and educated at Iowa and Harvard universities. He spent four years in Europe in research on immigration, then joined the staff of the University of Illinois (1928), becoming professor of history in 1930. His major works, published posthumously, include: *The Immigrant in American History*; *The Mingling of the Canadian and American Peoples*; and *The Atlantic Migration 1607–1860*, awarded a Pulitzer prize in history (1941).

**HANSEN, PETER ANDREAS**, 1795–1874, Danish astronomer, was born at Tønder in Schleswig. Trained as a watchmaker, he left his trade in 1820 to study astronomy under H. C. Schumacher at the Altona observatory. In 1825 he became director of the observatory at Gotha. There he developed his now-classic methods of lunar and planetary research and published his many writings, including *Investi-*

*gations of the Mutual Perturbations of Jupiter and Saturn.*

**HANSEN'S DISEASE.** See **LEPROSY**.

**HANSOM, JOSEPH ALOYSIUS**, 1803–82, English architect and inventor, a native of York, who found his true sphere in architectural work, ecclesiastical and domestic, chiefly for the Roman Catholic Church. His name is preserved in the "HANSOM" CAB for which invention (1834) he received only £300. He established *The Builder* in 1842.

**HANSOM CAB**, a light, two-wheeled covered carriage holding two passengers and having an elevated seat at the back for the driver. The wheels are large, and there are a strong high dashboard and two folding doors in front protecting the passengers from rain and dust. The vehicle was named for Joseph Hansom, its inventor. See **CARRIAGE**.

**HANSON, ADOLPH MELANCHTON.** See **COLLIP, JAMES BERTRAM**.

**HANSON, HOWARD**, 1896–, American composer, conductor, and educator, was born in Wahoo, Neb. Graduated from Northwestern University at 19, he accepted the professorship of theory and composition at the College of the Pacific in San José, Calif., a year later, and in 1919 became dean of its Conservatory of Fine Arts. When Hanson's score for the *California Forest Play of 1920* and his symphonic poem, *Before the Dawn*, won him the 1921 Prix de Rome, he left the conservatory to live in Italy. On his return to the United States in 1924 he became director of the Eastman School of Music of the University of Rochester. Noted for his promotion of American composers, he inaugurated the annual American music festivals given by the Rochester Philharmonic Orchestra. In 1944 Hanson was awarded the Pulitzer prize for his Symphony No. 4. His other works include *Nordic Symphony* (1922), *Lament for Beowulf* (1925), *Romantic Symphony* (1930), and the opera, *Merry Mount* (1934).

**HANSON, JOHN**, 1721–83, American Revolutionary leader, was born in Charles County, Md., and becoming a representative of his county in the Assembly, he served almost every year from 1757 to 1781. Hanson was active against British colonial legislation preceding the Revolution. Serving as a delegate to the Continental Congress, he succeeded in getting Virginia and other states to give up their claims to unsettled lands west to the Mississippi so that Maryland would ratify the Articles of Confederation. On Nov. 5, 1781, he was elected president of the Congress of the Confederacy and has been referred to as the first president of the United States, though his duties were only those of presiding officer.

**HANTHAWADDY**, a district, Lower Burma, in Pegu Division, on each side of the Rangoon River S of Rangoon, formerly containing the Rangoon area, which was detached as a separate district in 1880; area 1,931 sq. mi.; pop. (1941) 459,552. Rice is almost exclusively raised in the district. There are large tracts of unreclaimed marshland.

**HANTS.** See **HAMPSHIRE**.

**HANYANG**, an industrial city, China, in Hupeh Province, situated S of Hankow at the junction of the Yangtze and Han rivers. Strategically important because of its location midway on the Peiping-Canton Railway and near the head of ocean navigation, Hanyang's industrial importance is due to near-by deposits of coal and iron ore. In her Twenty-one Demands in 1915, Japan asked the control of the Hanyehping Iron Works of Hanyang, which produced a large portion of China's prewar iron. Pop. (1947 est.) 250,000.

H. T. CHU

**HAPARANDA**, most northerly Swedish town on the Gulf of Bothnia, in Norrbotten County; on the Finnish boundary two miles N of the mouth of the Tornealu River, with a harbor at Salmio. Haparanda is best known for its meteorological station. It also has shipbuilding yards and fisheries, and exports tar, salmon, lumber, and articles made by the Lapps. Pop. (1949) 2,890.



**HAPEVILLE**, city, NW central Georgia, in Fulton County, on the Central of Georgia Railroad and U.S. highways 19 and 41, about 7 miles S of Atlanta, in an agricultural region. During the Civil War, the farms and woods of the region were overrun by the armies. Hapeville was incorporated in 1891 as a suburban community whose residents work either in Atlanta or East Point. Pop. (1950) 8,560.

**HAPGOOD, NORMAN**, 1868–1937, American editor and author, was born in Chicago. After graduating from the Harvard Law School in 1893, he engaged in newspaper work until 1903, when he became editor of *Collier's Weekly*. He held the post until 1912, while the magazine was in its "muckraking" period, exposing governmental and business abuses and corruption. He later edited *Harper's Weekly* (1913–16) and *Hearst's International* (1923–25), and during 1919 was U.S. minister to Denmark. He wrote biographies of Lincoln, Washington, and Webster, and a number of other books, including *The Stage in America* (1901), *Industry and Progress* (1911), and *The Advancing Hour* (1920). *The Changing Years* (1930) is his autobiography.

**HAPSBURG**, or **HABSBURG**, an illustrious Austrian family, deriving its name from the castle of Hapsburg (Hawk's Castle), built by the Bishop of Strasbourg about 1021, on the banks of the Aar, in the Swiss canton of Aargau. The Bishop's nephew, Werner I, was the first Count of Hapsburg, but the first distinguished member of the family was Albert III, who added to his estates several Swiss districts near Zürich and Lake Lucerne. Albert's son, Rudolf I, died in 1232, and the estate was divided between his sons, Albert IV and Rudolf II, the latter founding the Hapsburg-Lauffenburg branch, which became extinct in 1415. Rudolf III, son of Albert IV, became emperor of Germany in 1273 (see **RUDOLF I**), and increased his possessions by seizing Austria, Styria, and Carniola, to which Carinthia and the Tyrol were added later. On the death of his son Albert, the imperial crown passed from the Hapsburgs, and for a hundred years following they were occupied in ruling their hereditary possessions. In 1438 Albert of Austria was elected emperor of the Holy Roman Empire, and for the first time Austria-Hungary and Bohemia were united under a Hapsburg ruler. From that time until 1806 all the emperors were Hapsburgs except Charles VII and Francis I. **MAXIMILIAN I** (1459–1519) inherited the Netherlands from his wife, Mary of Burgundy, and through the marriages of his grandchildren again brought the crowns of Hungary and Bohemia under Hapsburg control. His grandson, **CHARLES V**, was the founder of the Spanish line of Hapsburgs. He had as his share of the family possessions Naples, Sicily, and Sardinia, to which he annexed (1535) the Duchy of Milan; Ferdinand, his brother, retained the Austrian possessions and became king of Bohemia (1526) and Hungary.

The Spanish line of Hapsburgs becoming extinct with the death of Charles II of Spain in 1700, the crown was claimed by the Austrian branch of the family, but war ensued, and it passed to the Bourbons. The male line of the Austrian branch ended with the death of Charles VI in 1740, but by the **PRAGMATIC SANCTION**, the crown was secured to his daughter, **MARIA THERESA**, who married Francis of Lorraine in 1745. After the dissolution of the **HOLY ROMAN EMPIRE** in 1806, the Hapsburgs continued to rule in Austria and Hungary until the end of World War I, and in some Italian principalities until 1860. The emperor-king **FRANCIS JOSEPH** died in 1916 and was succeeded by his grand-nephew Charles, who abdicated in November, 1918. His eldest son, **Otto** (1922–), became claimant to the thrones of Austria and Hungary. See **AUSTRIA**, History; **HUNGARY**, History.

R. W. M.

**HARAKIRI**, or **Seppuku**, the Japanese feudal procedure of suicide. The literal meaning: *hara*, abdo-

men; *kiri*, to cut. The Japanese themselves prefer the pronunciation seppuku, seldom or never using the word harakiri, which has become popularized in the Occident. The motives for seppuku were: a protest or exhortation to one's lord or superior; to thwart imminent capture by an enemy; "following one's lord in death"; to solve an impossible situation by removing oneself as the focus of difficulty; as apology for incompetence or wrongdoing; and also as the most honorable form of execution. When not done under stress, seppuku entailed a rather elaborate ceremonial, depending on the rank of the person. The act was performed with a very short sword, plunged into the abdomen at the left, then drawn slightly downward and to the right. The word applied to this particular form of suicide, and no other. Part of the old **SAMURAI Code**, seppuku is still prevalent in modern Japan. In 1912 Baron and Baroness Nogi performed the act in accord with ancient tradition on the day of the funeral of Emperor Meiji in Tokyo, and during World War II many Japanese military men committed harakiri. Seppuku is a favorite theme in Japanese classic drama, a notable instance being that of the daimyo Asano, condemned to die for having drawn his sword in the shogun's palace, in the play *Shijushichi Shishi* (*Forty-seven Ronin*). P. W.

**HARAR**, province, Ethiopia. One of the largest and most fertile of the Ethiopian provinces, Harar has a pleasant climate and a widely varied cultivation; it is generally at an elevation of between 4,000 to 5,000 feet. **DIREDAWA**, the most progressive city of Ethiopia, some 35 miles northwest of HARAR, the capital, was for a long time the terminus of the Franco-Ethiopian railway to Djibouti in French Somaliland. The railway is now extended to the Ethiopian capital, **ADDIS ABABA**. The people of the province are nomadic, and comprise Shoas, Somalis, and Gallas.

**HARAR**, city, Ethiopia, capital of Harar Province, about 220 miles E of Addis Ababa and 35 miles SW of Diredawa. Harar is an ancient walled city, situated at an altitude of some 5,000 feet, with steep, narrow, and dirty streets and a generally oriental aspect. The buildings are low, flat topped, and built of mud. However, the palace of the provincial governor, the mosques, and a Coptic church are remarkable among their surroundings. Harar is still an important center of the caravan trade and deals in coffee, durra, the Kat plant (used as a drug by the Mohammedans), ghee, cattle, mules, camels, skins and hides, ivory, and gums. Cotton is the chief import. The city was founded in the seventh century by Arabs from Yemen; it was first visited by a European when Sir **RICHARD BURTON** stayed there 10 days in the disguise of an Arab in 1854. In 1875 the city was occupied by an Egyptian force and remained under Egyptian control until the troops were withdrawn in 1885 under threat of the Mahdi uprising in the Sudan. In 1887 Harar was captured by Menelik I, king of Shoa (afterward king of Ethiopia). Pop. (1949 est.) 25,000.

**HARASZTHY DE MOKCSA, AGOSTON**, c. 1812–69, American pioneer, was born in Futtak, Hungary. Coming to the United States in 1840, he founded what is now Sauk City, Wis., and constructed the first building at Baraboo (1845). He went to California in 1849 and was instrumental in establishing the commercial wine industry in that state, importing vines from Hungary and planting them in the San Francisco area. In 1858 he planted California's first large vineyard. By appointment of the legislature, he toured European wine-producing countries, bringing back about 300 varieties of vines, some of which were successfully grown in the state.

**HARATIN**. See **BERBERS**.

**HARBIN**, or **Pinkiang**, cosmopolitan city, China, in Manchuria, Kirin Province, on the right bank of the navigable Sungari River, main affluent of the Amur, 500 miles N of Port Arthur, 220 miles NE of Mukden, and 250 miles NW of Vladivostok, at the

converging point of five railway lines to which Harbin owes its great importance. One line leads from Harbin to Vladivostok—via Mutankiang—in the east; one to Manchouli, the border station to the U.S.S.R., in the west; one via Hailun to Heiho on the Amur River and farther to the U.S.S.R. in the north; and one via Changchun (Hsinking) to Mukden and from there to Dairen. Steamboats and junks go from Harbin to all larger towns and cities along the Sungari River and its tributaries and air lines connect the city with Lungkiang (Tsitsihar) and Manchouli, and Mukden, Dairen, and Shingishu, a Korean border town. Electric street cars, busses, and rickshas are the chief means of transportation within the city, with the typically East-European sledges used during winter time.

Harbin lies in a densely populated plain where rich crops of soybeans, wheat, corn, and maize are cultivated and where good grazing ground is found. The district has some mineral fields. Flour, sawmills, soybean and beet sugar factories, distilleries, leather and meat-packing industries, oil machine factories, and brickworks have sprung up rapidly during the last four decades. Harbin's chief exports are soybeans, bean cake and bean oil, tobacco, wheat flour, furs, cotton and woolen piece goods, leathers, beer, lumber, soap, candles, and veneer. Exports to other countries declined rapidly after Japan gained control of Manchuria. The Japanese absorbed Harbin's trade almost entirely after 1936, especially after they had bought the Russian shares of the Chinese Eastern Railway in 1935 and renamed it the North Manchurian Railway.

**History.** Originally a tiny fishing village and local wheat mart, Harbin became an important city as the administrative center of the Chinese Eastern Railway, founded in 1896 under the czar. During the Russo-Japanese War, Harbin was for some time the chief base of the Russian army. It remained the administrative center of the Chinese Eastern Railway, which was jointly administered by China and the Soviet Union after 1924. In 1926 a Chinese self-governing body was instituted in place of the Russian Municipal Council. Its opening to foreign trade in 1907 increased the tremendous speed of Harbin's development from a small town to an internationally important city, which, after the Russian revolution, absorbed a great number of White Russian refugees. With one-third of the population Russian by 1925 (the number declined later), Harbin presents the unique picture of a city of mixed East European and East Asiatic characteristics. It is divided into various sections and has several institutions for research and higher education. In 1934, Harbin was made the seat of the provincial government of Pingkiang, a newly created province, by the Manchukuo puppet government. Harbin's population has grown very rapidly, from 330,000 in 1930 to 700,000 in 1946, comprising mainly Chinese, Russians, Japanese, and some Mongols.

HILDE KIANG

Natives load flour on a river boat at Harbin

EWING GALLOWAY



## HARBOR AND BREAKWATER

*Providing refuge and protection from the rigors of stormy seas*

**HARBOR AND BREAKWATER.** A harbor is a body of water, easily accessible to routes of maritime traffic, in which ships may lie with safety during periods of storm or while taking on or discharging cargoes. The term harbor is generally associated with a location that is provided with aids to navigation and facilities for mooring or berthing of vessels. It may also be applied to harbors for seaplanes. The essential features of a good harbor are (1) a body of relatively calm water of ample but not excessive depth at all stages of the tide, and with sufficient area for anchorage and maneuverability of vessels; (2) one or more navigable entrances so located as to provide maximum protection against admission of high seas into the harbor; and (3) facilities for transferring and storage of cargoes, and for servicing and repairing ships.

### CLASSIFICATION

Harbors may be classified according to the nature of their origin, i.e., as natural harbors or artificial harbors, or according to the purpose for which they exist, i.e., as harbors of refuge, commercial harbors, naval, small boat, or seaplane harbors.

**Natural Harbors** are those that are protected from storms by the configuration of the coast line. They possess a sufficient depth of water, an adequate anchorage area, and an entrance of such width and shape as to reduce to a minimum the dangers to entering craft. Many of the important harbors of commerce are natural harbors formed by the mouths of rivers, such as those of New York and London, although remedial work is generally necessary to accommodate modern shipping. Dredging is in many cases a periodic, if not a continuous, operation, especially in the mouth of a river carrying a heavy silt burden. Frequently natural harbors exist in conjunction with a bay or sound, either partially or entirely enclosed by land except for an entrance, as in the case of San Francisco and Seattle. Many excellent natural harbors are of little commercial importance because they lie off the routes of commerce, though they may have strategic value.

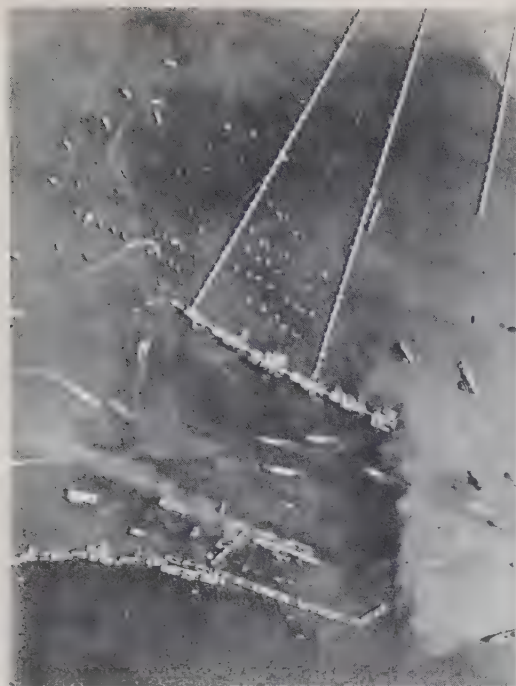
**Artificial Harbors** are by far the most numerous because this classification includes those natural harbors that have required engineering works in order to meet the demands of shipping as well as those harbors whose efficiency is entirely due to works of man. Many of the important harbors of the world, such as Liverpool, Philadelphia, and the Port of Los Angeles, are artificial harbors. Practically all of the harbors of the Great Lakes are in this class. Artificial harbors have been built by dredging a basin of sufficient size at a distance upstream from the mouth

Small boat harbor along the Chicago lake front

CHICAGO PARK DISTRICT







WAR SHIPPING ADMINISTRATION

### Prefabricated harbor on the Normandy coast

of a river, together with an entrance channel, as in several of the port cities of the Gulf of Mexico.

**Harbors of Refuge** exist solely for the purpose of affording a haven for vessels overtaken by storm. Where a natural harbor is sufficiently sheltered from the worst storms so that ships can find a tranquil area, the only construction necessary is the establishment of aids to navigation. More often the necessary tranquility must be effected by the construction of one or more breakwaters. The very purpose of such harbors requires that they be accessible along dangerous coasts. Thus they may be provided along an open stretch of coast and be dependent entirely on breakwaters for a still area. An example of this type is the Peterhead Harbor of Refuge on the northeast coast of Scotland.

**Commercial Harbors** are those that are adapted to the accommodation of shipping engaged in commerce by affording not only shelter and means for loading and unloading cargo. Such harbors, in their ultimate development, should be equipped not only with wharves, docks or piers, warehouses, and cranes for the movement of cargo, but also with facilities for fueling, and with dry docks capable of permitting the expeditious repair of ships.

**Naval Harbors** are those which exist primarily for fleet purposes, frequently in conjunction with a commercial harbor. These include both (1) the large permanent naval base with extensive shore facilities protected by heavy fixed fortifications, as at Pearl Harbor or Singapore, and (2) the advance base, established during wartime as needed for offensive operations against an enemy, equipped with facilities of the movable type. Guam, Saipan, etc., were such harbors during the war with Japan in the Pacific. Artificial harbors for invasion purposes may assume gigantic proportions, as did those established on the Normandy beaches during the European invasion of World War II. The shelter was provided by prefabricated units, towed from the point of manufacture in England and sunk in position in the wake of the invasion forces. There was an outer floating breakwater of steel floats moored end to end, designed to dampen the effect of the sea from the winds expected

during the summer months; a concrete caisson breakwater in six different sizes to suit various depths of water up to  $5\frac{1}{2}$  fathoms (33 feet); a secondary breakwater of sunken ships for small boat havens; and a system of floating pierhead structures connected in turn by an assembly of prefabricated pontoon bridges to the high-water line of the beach. The berthing and unloading facilities accommodated all types of ships at all stages of the tide.

**Small Boat Harbors** are sheltered bodies of water of shallow depth, affording safe and convenient anchorage for many types of small craft, frequently in conjunction with a larger harbor. There is usually a yacht club, boathouse, and facilities for hauling out and repair. These harbors occupy a prominent place in the recreational facilities available in many cities, and are important commercially for sustaining an extensive market in various types of sport craft, together with the many accessories.

**Seaplane Harbors** are sheltered basins, frequently near the mouth of a river, or man-made lagoons of depths up to 15 feet, providing a water surface sufficiently undisturbed by weather to ensure at all times safe arrival and departure of seaplane traffic. Waterways for the use of seaplanes should preferably be set apart from shipping lanes.

**Harbor Design**, by modern methods, requires careful study. Many harbors have long histories of continued growth. Since waterfront property is had only at a premium, the growth by stages does not always coincide with the most advantageous plan for the ultimate development. The design and layout of a harbor is an engineering task of considerable complexity. The construction of works of man disturbs the regimen of nature in such a way that it is rarely possible to predict what the resultant course of the currents will be. Considerable progress has been made in recent years in harbor analysis by tests on harbor models.

In order to prevent the encroachment of waterfront structures upon the harbor proper, harbor lines are established that set the bounds beyond which the engineering works may not extend. The pierhead line defines the limit of piers or other types of open construction, while the bulkhead line sets the bounds for the filled body or closed type of water-front structure.

**Harbor Works** comprise a long list of engineering structures, including wharves, piers, bulkheads, quay walls, breakwaters, jetties, sea walls, groins, etc. These may be grouped into two general classifications, namely, works for the mooring or berthing of vessels, and protective works. A wharf is a structure alongside which vessels may tie up for receiving and discharging cargo and passengers. Piers are wharves projecting out from shore. Bulkheads, quay walls, etc., are primarily retaining walls along a water front, the term "bulkhead" frequently applying to the wall between the inshore ends of adjacent piers. Unlike many structures which frequently never carry full design loadings, harbor works must resist loads that are very real and, in many cases, greater than estimated. Harbor works have provided many examples of structural failure, due in large part to the uncertainties regarding the magnitudes of the forces involved. Bulkheads are more susceptible to failure at the time of low tides, when natural load differentials are at or near their maximum.

### BREAKWATERS

A breakwater is a structure built in water for the purpose of dissipating the force of waves and of providing a tranquil area behind it. A *mole* is a breakwater the top of which is used as a quay or wharf. A *jetty* is constructed in a manner similar to a breakwater but has as its primary function the preservation of a channel from the deposit of silt and sand by river and ocean currents. *Sea walls* serve to protect a shore line from the destructive effects of wave action. *Groins*

are structures extending out from shore to prevent damage by erosion from littoral currents.

Because breakwaters must insure the continuity of operations at a port under all conditions of weather, great care must be taken in their location and design. In order to provide the greatest protected area with the least expense, advantage must be taken of all available cover afforded by the configuration of the shore. At the same time, an attempt should be made to keep the structure as much as possible in shallow water while enclosing the greatest amount of deep water. Theoretically, a breakwater built parallel to the waves generated by the worst and heaviest storms should give the greatest protection for the least length. But such a direction exposes the structure to the maximum forces of the sea and these can be withstood only by the heaviest and largest structure. The chosen trace is usually one that, by taking advantage of the configuration of the shore line, is oblique to the line of the worst storms.

**Types.** There are several types of breakwaters, namely, the wall, the rubble mound, and the composite. Pneumatic breakwaters, utilizing compressed air to moderate the roughness of the sea, have been proposed, together with methods for harnessing the energy of ordinary waves for use in operating the pneumatic breakwater. The *wall type* includes those structures with vertical, battered, or slightly inclined exposed faces. Structures of this type have been constructed of masonry, mass concrete, timber cribs, concrete caissons, pile piers, and cellular steel caissons. If the wall is built in water of such a depth that it is subjected only to the oscillatory action of waves, it need only withstand the hydrostatic pressure exerted by the depth of the water. If, however, it is subject to the impact of breaking waves, the forces it must withstand are often of tremendous proportions. This force may be as great as three and a half tons per square foot on a plane surface.

The prefabricated breakwaters for the artificial harbors on the Normandy coast were of the wall type, the individual reinforced concrete units of which were comparable in size to a five-story office building. The largest had a displacement of over 6,000 tons and required 22 minutes for sinking into position.

The *rubble mound type* of breakwater is characterized by its flat slopes and by the fact that it is composed of large stones or precast concrete blocks laid in courses or allowed to take their natural slope after having been dropped at the site. The large stones on the exposed slopes, sometimes called "armor" rock, frequently range in weight from 5 to 25 tons each. These receive the initial wave impact. The large inner mass, or core, of smaller rock, up to five tons in weight, supports the armor and serves to dissipate the impact transmitted therefrom. This type is adapted to any depth of water and to practically any conditions of foundation. It has a certain "permeability," meaning that a portion of the wave energy is allowed to pass through the stone mass.

*Composite type* breakwaters may have a mound foundation with a wall superstructure, or may consist of a foundation and core of dredged materials, with the remainder, including the exposed faces, of stone, as in the rubble mound.

Of all structures, breakwaters are probably the most severely tried, because of the relentless action of the waves that attack them. Wave pressures on breakwaters and the stability of various breakwater types are subjects receiving special study and experimentation both in America and Europe. Several breakwater failures have focused attention on the need for better knowledge both of the possible applied forces and the manner in which these forces affect the structure. These considerations, of interest to all countries, have caused the XIVth International Navigation Congress to create a special international committee to study wave action on marine works. This committee is seeking to correlate the efforts of the

various groups and to extend the general knowledge by pooling the results for the benefit of all. See DOCK; NAVAL BASES.

JAMES R. AYERS

**BIBLIOG.**—W. Shield, *Principles and Practice of Harbor Construction* (1895); B. Cunningham, *Principles and Practice of Dock Engineering* (1910); C. McD. Townsend, *The Hydraulic Principles Governing River and Harbor Construction* (1922); H. E. Haferkorn, *Army War College, D.C.* (1932); *Engineering* (London), vol. 155; *The Dock and Harbor Authority*, vol. XXV and XXVI; *Transactions, American Society of Civil Engineers*.

**HARBORD, JAMES GUTHRIE**, 1866–1947, American army officer, was born in Bloomingdale, Ill. He entered the army in 1889 as a private, and rose to brigadier general (1918) and major general (1919). He was chief of staff of the A.E.F. in France (1917), commander of the Supply Service in France (1918–19), and again chief of staff of the A.E.F. (1919). Retiring from the army in 1922, Harbord became president of the Radio Corporation of America (1922–30) and chairman of the R.C.A. board in 1930.

**HARBOUR GRACE**, town, Canada, SE Newfoundland, on Conception Bay, on the Canadian National Railroad, about 27 miles WNW of St. John's. The town is an important fishing port. Many pioneer transatlantic flights started here. Pop. (1951) 2,331.

**HARBURG**, called Harburg-Wilhelmsburg since 1927, seaport town, Germany, formerly in the Prussian province of Hanover, incorporated in the state of Hamburg in 1937, situated on the S branch of the Elbe River, separated from the city of Hamburg by the two branches of the river and the island of Wilhelmsburg, which was incorporated into the city in 1927. Harburg and Hamburg are connected by rail (7 mi.), street car, and steamship. Before World War II Harburg was the world center of palmkernel manufacturing; it also had important mineral oil, rubber, jute, and machinery factories, and shipbuilding yards. The Wilhelmsburg part of the town was known for its wool and machinery factories and the manufacturing of all materials needed for shipbuilding and ship equipment. Harburg-Wilhelmsburg was frequently bombed in World War II. The very badly damaged town surrendered to the British in May, 1945. Pop. 105,750.

**HARD LABOR**, a sentence to compulsory work as part of a prison term. Use of the word "hard" is misleading: the courts have ruled that the work is to be no more severe than that performed by free men.

The history of hard labor reveals that early societies considered it purely punitive. From the 12th century until the 1880's, work performed by prisoners was tantamount to slavery. During this period and until comparatively recent times, governments and prison officials regarded the work of their wards as an added source of revenue. It has only been since the activities of modern prison reformers that hard labor has been viewed as a step toward rehabilitation through vocational training. In some nations the prisoner is paid (in the United States from 5 to 50 cents a day) for his labor.

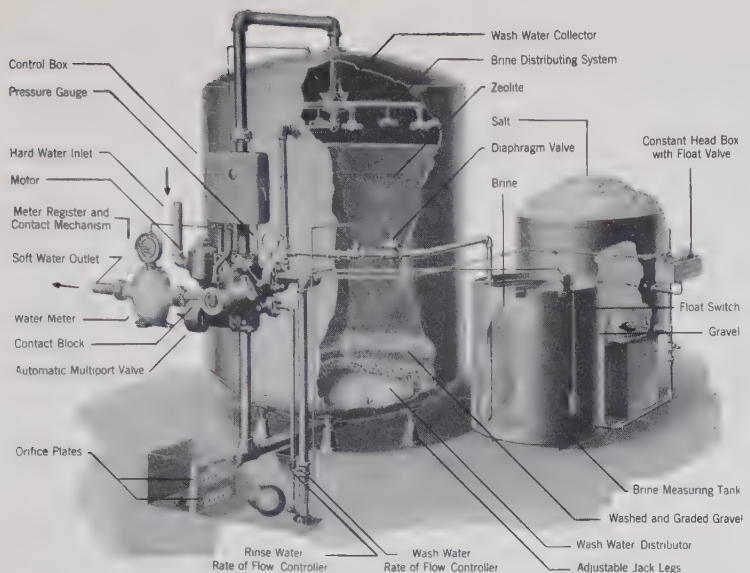
The 1885 survey of prison labor in the United States showed that 73.5 per cent of prisoners in state and Federal institutions were "productively employed." This figure fell to 52 per cent in 1932, and 44 per cent in 1940. By 1950 only about 20 per cent of inmates in state prisons were employed in productive industries.

During World War II state prisons produced large quantities of war materials which were turned over to the Federal government. The Federal Prison Industries, Inc., is the Federal agency in charge of industrial programs in Federal prisons. Products are sold only to other Federal government departments and agencies and at the generally prevailing market price for comparable goods. See PRISON.

MELVIN ALTSCHULER

**HARD WATER.** When water contains certain dissolved minerals that will react with soap to form





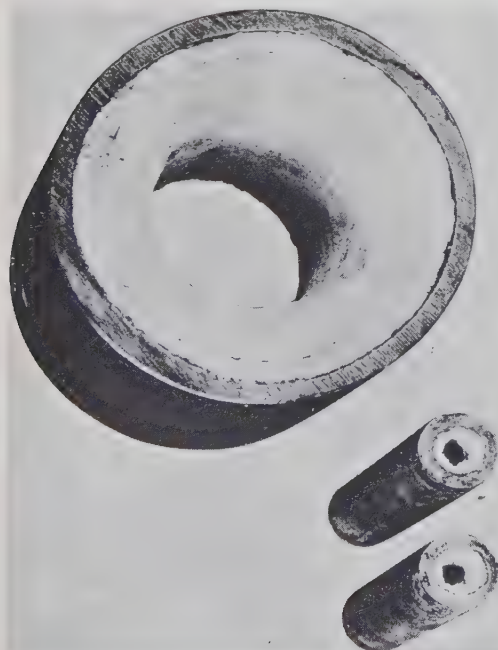
Photodiagram of a commercial water softener

THE PERMUTIT CO.

insoluble curds the water is said to be hard. In limestone regions the dissolving action of soil water (containing dissolved carbon dioxide) on the calcium carbonate in the limestone results in the formation of calcium bicarbonate:



The presence of dissolved calcium bicarbonate causes a type of hardness known as *carbonate hardness* or *temporary hardness*. In regions where the water seeps through dolomite rocks, magnesium bicarbonate,  $\text{Mg}(\text{HCO}_3)_2$ , is similarly formed and also causes carbonate hardness. In some natural waters the hardness is due to ferrous bicarbonate,  $\text{Fe}(\text{HCO}_3)_2$ . The presence in water of the dissolved sulfates of calcium or magnesium produces *noncarbonate hardness* or *permanent hardness*.



THE PERMUTIT CO.

Scale formation in section of boiler tube

**Disadvantages of Using Hard Water.** The presence of calcium, magnesium, or iron salts in water to be used for laundry purposes is objectionable because these salts react with soap to form insoluble compounds that adhere to the fabric and are difficult to rinse away. Furthermore, washing with hard water is very wasteful of soap because suds are not formed until the calcium, magnesium, and iron have been completely precipitated out.

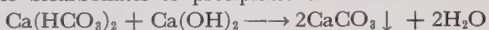
The use of hard water in steam boilers results in the formation of "boiler scale" in the boiler tubes. Since this scale is a poor conductor of heat, much fuel is necessarily wasted in generating additional heat to maintain the required steam supply. The increased rate of heating causes the outside and inside of the tubes to rust even more rapidly, thus decreasing the life of the boiler.

The use of hard water is objectionable in the dyeing industry since the minerals in some cases affect the color of the dyes and sometimes produce spots on the cloth. Hard water also causes difficulties in the refining of sugar, in the leather industry, in the production of many chemicals, in storage batteries, and in automobile radiators.

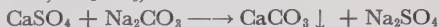
**Methods of Softening.** A water softening process involves such treatment of the water as will remove any calcium, magnesium, or ferrous ions that may be present. Carbonate hardness may be removed by boiling the water, which causes the bicarbonates to decompose and form the insoluble carbonates:



Carbonate hardness may also be removed by the addition of slaked lime,  $\text{Ca}(\text{OH})_2$ , which reacts with the bicarbonates to precipitate calcium carbonate:

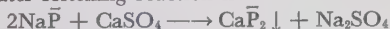


Noncarbonate hardness may be removed by adding soda ash,  $\text{Na}_2\text{CO}_3$ , to the water:

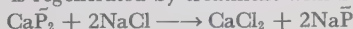


Other chemicals that are employed in softening water include trisodium phosphate, borax, milk of lime, sodium metasilicate, and sodium hexametaphosphate. The last-named in its reaction with calcium and magnesium ions forms soluble calcium and magnesium compounds which do not react with soap to form insoluble curds that adhere to clothes and dishes. Calgon is the trade name for a sodium hexametaphosphate water softener.

A group of water softeners that are convenient for use both in the home and in industry are the *zeolites*. These substances are natural or artificially prepared sodium aluminum silicate compounds which soften water by the process of filtration. The soluble calcium and magnesium compounds in the hard water react with the zeolite to form insoluble calcium and magnesium compounds which remain in the filter. Permutit is the name of an artificially prepared zeolite that is in common use. If its formula is represented by  $\text{NaP}$  (where P is an aluminum silicate radical), the water softening reaction is:



When all of the  $\text{NaP}$  has been converted to  $\text{CaP}_2$ , the  $\text{NaP}$  is regenerated by treatment with brine:



Synthetic resins have been developed which remove metallic ions, such as calcium and magnesium, by ION EXCHANGE reactions. These ions are exchanged for hydrogen ions by filtering the water through the resins. After use, the resin is regenerated by treatment with an acid. E. M. W.

**HARDACNUT.** See **HARDICANUTE.**

**HARDANGER FJORD**, Norway's second largest fjord, on the SW coast midway between Bergen and Stavanger; an inlet extending 114 miles from the Atlantic into the Hardanger Fjeld. The inner Hardanger, approached through islands, has several branches including Kvindherreds, Mauranger, Silde, Samlen, and the magnificent Sor. Into the Sor, near Odda, falls the famous Skjaeggedalos (525 ft.), draining Lake Ringdalsvand. The Eid, which receives the Bjoreia River, has the Vöringfos Falls (535 ft.) near Vik. The shores of the Hardanger and of its branches are lined with orchards, fertile farm lands, and forests. The picturesque scenery attracts many tourists and has been celebrated in verse by Wergeland and other native poets. The people of the district retain their ancient customs, dialect, dress, and handicrafts.

**HARDANGER VIDDA**, a high, rocky plateau of S central Norway, extending over the counties of Buskerud, Hordaland, and NW Telemark. It ends in Hardanger Fjeld (mountain ridge), whose peaks, Hardanger Jokull and Hallingskarvet, stand at the head of the Hallingdal (valley).

**HARDECANUTE.** See **HARDICANUTE.**

**HARDEE, WILLIAM JOSEPH**, 1815-73, American Confederate soldier, was born in Savannah, Ga. He was graduated from West Point in 1838, and by 1844 had advanced to the rank of captain. In the Mexican War he was brevetted major for service at Monterey, and lieutenant colonel for his conduct at St. Augustine. In 1856 he was appointed commandant of cadets at West Point but resigned from the U.S. Army in 1861, and became a colonel in the Confederate Army; served in the West, commanded a corps in the Army of Mississippi, and led the Confederate line at the battle of Shiloh. With the rank of lieutenant general he was in charge of the left wing of Bragg's army which invaded Kentucky (September, 1862), and in December, 1863, he succeeded General Bragg in command of the Army of Tennessee. He served in the Atlanta campaign under General Johnston, and afterward commanded the Department of South Carolina, Georgia, and Florida, but was unable successfully to oppose General Sherman at Savannah. Thereafter he served under General Johnston until the latter's surrender in April, 1865. After the war he settled on a plantation in Alabama. He wrote *Hardee's Tactics*.

**HARDEN, Sir ARTHUR**, 1865-1940, English biochemist, was born in Manchester and studied at Owens College, Manchester, and the University of Erlangen. He taught at the University of London and was director of the biochemical department of the British Institute of Preventive Medicine (later known as the Lister Institute). His research was principally on the chemical processes involved in the fermentation of sugar by yeast cells. He discovered a method by which fermentation might be augmented through the addition of inorganic phosphates. For this research he shared with HANS VON EULER-CHELPIN the 1929 Nobel prize in chemistry, won the Davy medal of the Royal Society (1935), and was knighted (1936). In addition to several textbooks, he wrote *Alcoholic Fermentation* (1911) and was co-editor of the *Biochemical Journal* (1913-37).

**HARDENBERG, GEORG PHILIPP FRIEDRICH VON.** See **NOVALIS.**

**HARDENBERG, KARL AUGUST, PRINCE VON**, 1750-1822, Prussian statesman, was born in Essenrode in Hanover. He was educated at Leipzig and Göttingen, and traveled in France and England. After 20 years in the service of Hanover and of Brunswick, he was appointed (1791) a Prussian min-

ister of state by Frederick William II, and in 1795 he was sent to Basle, where he negotiated peace between Prussia and the French Republic. In 1803 he became first Prussian minister under Frederick William III. His internal policy aimed at the development of Prussia by economic measures, such as the abolition of many trade privileges, organization of education, abolition of serfdom, and administrative economy; and his external policy was that of consistent, though sometimes necessarily secret, opposition to Napoleon. Although in 1806 he was dismissed at the latter's instigation, in 1810 he was appointed chancellor of state in succession to Stein, and continued that statesman's internal reforms. He played an important part in the war of liberation, and was a signatory to the first treaty of Paris (1814). In 1817 he reorganized the council of state, of which he became president. He was present at the congresses of Aix-La-Chapelle, Carlsbad, Vienna, and Verona.

**HARDENING, MECHANICAL**, a method for imparting hardness to metals by cold-working. Single-phase metals or alloys do not respond to hardening by heat treatment but can be hardened by passing them through rolls or by peening at room temperature. Brasses, for example, do not respond to hardening by heat treatment, hence are hardened by cold-rolling in the mill. Wire becomes hardened in the wiredrawing operation and must be annealed before subsequent drawing operations can be performed. Music wire, however, is left in the cold-drawn or mechanically hardened condition. The surface of flat and of coiled springs is sometimes mechanically hardened by shot-peening to increase the resistance of the spring to repeated stresses, that is, to increase fatigue life. The shot-peening increases the fatigue life of the springs by increasing not only the hardness but the tensile strength of the spring surface. J. E. FOSTER

**HARDENING OF ARTERIES.** See **ARTERIOSCLEROSIS.**

**HARDHACK.** See **SPIRAEA.**

**HARDICANUTE, HARDECANUTE, or HARDACNUT**, c. 1019-42, king of England, son of CANUTE and Emma of Normandy. He was under-king in Denmark at the time of his father's death (1035), and the Witan gave the crown to his half-brother Harold, reserving Wessex for Hardicanute. The West Saxons deposed him in 1037 for tarrying in Denmark, and he made preparations for invading England when Harold died (1040). The Witan then offered Hardicanute the crown. His short reign of two years was characterized by brutality and extortion. See **HAROLD I.**

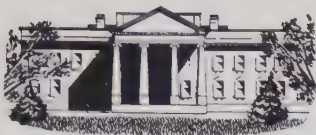
**HARDIE, JAMES KEIR**, 1856-1915, British labor leader, was born in Lanarkshire, Scotland, and worked in the Scottish coal mines from childhood. He became editor of the *Cumnock News* (1882-86), and in 1887 founded the *Miner*, later known as the *Labour Leader*. He was elected to Parliament for Southwest Ham (1892-95); from 1900 he represented Merthyr-Tydfil. Hardie was a founder of the Independent Labor party (1893) and a leader of the party in the House of Commons. He was the author of *From Serfdom to Socialism* (1907), and *India: Impressions and Suggestions* (1909).

**HARDIN-SIMMONS UNIVERSITY.** See **COLLEGES.**

**HARDING, JAMES DUFFIELD**, 1798-1863, English water color painter, a native of Deptford, near London, who is remembered for his paintings in water colors, in which he abandoned the exclusive use of transparent colors with results so pleasing that the system was universally adopted by younger artists. His *Sketches at Home and Abroad* (1836), *Park and Forest* (1841), and *Picturesque Selections* (1861) attest his skill as a lithographer. He was a prolific author of educational manuals and textbooks and was a popular and successful teacher.

**HARDING, SAINT STEPHEN.** See **STEPHEN HARDING, SAINT.**

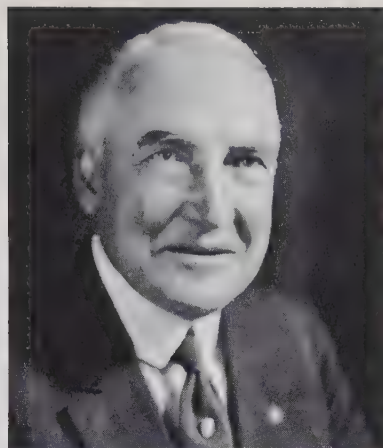




## WARREN GAMALIEL HARDING

29th President of the United States

1921 - 1923



HARRIS & EWING

**HARDING, WARREN GAMALIEL**, 1865–1923, 29th president of the United States. He was born of Scotch descent on a farm near Corsica (now Blooming Grove), Ohio, on Nov. 2, 1865, the eldest of a family of eight. At the age of 14 he entered Ohio Central College at Iberia, where he took work of academy grade. Before leaving school in 1882 he served a short time as editor of the college paper. He took employment on the *Marion* (Ohio) *Mirror*, but soon transferred to the *Marion Star*; his father purchased this small daily in 1883 and the next year turned it over to the son. Harding retained his interest in this paper until 1923, shortly before his death; under his ownership and control it became one of the leading dailies in the smaller cities of Ohio. In 1891 Harding married Florence Kling of Marion.

Entering local politics as a protégé of Senator Joseph B. Foraker, one of the leading members of Congress, Harding soon forged ahead because of his great affability, his prepossessing appearance, and his effectiveness as a speaker. He served two terms in the Ohio Senate (1900–1904) and was lieutenant governor (1904–6), but when nominated for governor in 1910 he was defeated by 100,000 votes. In 1912, although not a candidate for office, he gave strong support to President Taft. In 1914 he defeated his old friend Foraker in the primaries for the Republican nomination for the Senate, and he was elected by a majority of 100,000.

During his one term in the Senate Harding had an undistinguished career. His voting record was characterized by political cautiousness; he can best be described as a “standpatter” and a nationalist. On the League of Nations issue he stood close to Senator Lodge, favoring strong reservations before ratification. He was above all an orthodox Republican. In 1916 he was chosen permanent chairman of the Republican convention which nominated CHARLES EVANS HUGHES.

In 1920 with the Republican Congress in a rebellious mood against the strong leadership of Democratic President Wilson, Senator Harding was put forward as a presidential candidate by a small group of senators. In Harding's favor was the fact that he was from Ohio, a populous and traditionally doubtful state. Yet when the balloting opened in the Republican Convention in Chicago he received only 65½ votes (including 39 from Ohio), being far behind General Leonard Wood, Governor Frank O. Lowden of Illinois, and Senator Hiram Johnson of California. But revelations of exorbitant primary expenditures discredited the two leaders, Wood and Lowden. When the balloting reached a deadlock the party leaders met late at night in a smoke-filled hotel room and selected Harding as the compromise candidate. Nomination followed on the tenth ballot.

With the country clearly in revolt against the

Democratic Party Harding conducted a quiet “front porch” campaign. With the country in such a mood Harding's slogan, “return to normalcy,” made a great appeal. Another slogan was “Less government in business, more business in government.” Meanwhile the Democratic nominee, Governor JAMES M. Cox of Ohio, was stumping the country in his advocacy of the League of Nations. On this issue Harding took an equivocal stand, at times vaguely giving support to some kind of “association of nations,” at other times denouncing the League as a fraud. He was supported by distinguished Republican leaders who were well known as advocates of the League, while at the same time Senators Borah and Johnson pleaded for votes for Harding to keep America out of the League. The election proved that the American people wanted to return to “normalcy”; Harding received 16,138,000 votes to 9,142,000 for Cox, the electoral votes being 404 to 127.

Harding's cabinet was headed by Charles Evans Hughes, an advocate of the League and perhaps the most respected and able leader in the Republican party; he made an outstanding record as secretary of state. To the Department of Commerce Harding named HERBERT HOOVER, who as food administrator during the war had exhibited real ability as an organizer and administrator. ANDREW W. MELLON, financier and industrialist of Pittsburgh, Pa., was named secretary of the treasury. To the position of attorney general the President named HARRY M. DAUGHERTY, a personal crony and the manager of his political campaign. Another unfortunate appointment was that of Senator ALBERT B. FALL of New Mexico as secretary of the interior.

In the field of foreign policy Harding immediately announced that the League issue was dead so far as the United States was concerned. Secretary of State Hughes immediately set about trying to build up a system of international co-operation outside the League. His important achievement was the success of the Washington Naval Disarmament Conference of 1921–22, establishing a 5–5–3 ratio for capital ships of the three great naval powers. President Harding sent a special message to Congress requesting American entry into the Permanent Court of International Justice with reservations, but in the ensuing battle with the extreme isolationists he gave no more than lukewarm leadership. Harding made no effort to revive the already-rejected Treaty of Versailles; instead, a separate peace treaty was drawn up with Germany and signed Aug. 25, 1921.

In the field of domestic legislation perhaps the outstanding action taken was the establishment of a national budget system, the culmination of a discussion of over 10 years. A program of aid to sick and disabled veterans was extended, but a soldiers' bonus

It happened when

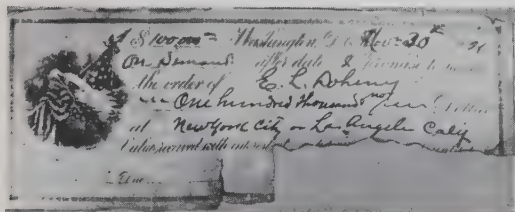
# Warren G. Harding

was president . . .



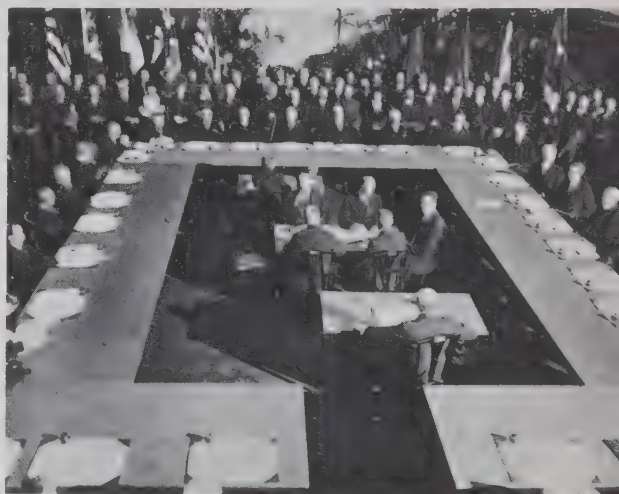
INTERNATIONAL NEWSREEL

Lincoln Memorial in Washington, D.C., was dedicated in 1922. From an old photo



P. & A. PHOTO

Teapot Dome Scandal was exposed in 1923. This is photo of a \$100,000 note which Fall gave to Doheny



INTERNATIONAL NEWS



ACME

Two Army Aviators, Kelly and Macready, in 1923 made first nonstop airplane flight across the U.S.

Naval Disarmament Conference at Washington in 1921 established the 5-5-3 ratio for capital ships

U.S. Army withdrew final members of occupation forces from the Rhine in 1923

ACME





bill met veto by the president on the ground that such legislation was opposed to the policy of financial retrenchment. In 1922 the highly protectionist Fordney-McCumber Tariff Act was passed. Under the leadership of Secretary Mellon income tax rates were drastically reduced, especially in the higher brackets, and expenditures were curtailed; under the program of economy a great reduction was made in the national debt. Another important law of the administration was that which restricted immigration and imposed the quota system for persons entering from other countries. In general the Harding administration was isolationist and nationalist, conservative in domestic policy and favorable to economic free enterprise and individualism.

Although Harding has been regarded as personally honest and motivated by good intentions, he was too easy-going to resist corrupt political influences. The first open scandal appeared in the Veterans' Bureau; the director, Charles R. Forbes, was forced to resign in 1923, and two years later he was convicted by a Federal court. Meanwhile a worse scandal was developing around the "Ohio gang," led by Postmaster General Daugherty. Later investigations revealed a widespread system of bribes and graft in economic concessions and contracts and even traffic in public offices. After the death of Harding, Daugherty was finally forced from the cabinet. Worst of all, however, was the Teapot Dome Scandal. It was revealed that Secretary of the Interior Fall had been bribed to lease the Elk Hill oil reservation to the Doheny corporation. Fall resigned and was finally convicted by a Federal court, but the bribegivers escaped punishment.

About the time these scandals began to break, President Harding left Washington for a 39-day tour of the western states and Alaska. He made numerous speeches in the Midwest and West. His last public speech, on July 27, 1923, at Seattle, dealt with the Alaska question. The following day he was taken ill with what seemed to be ptomaine poisoning; he was hurried to San Francisco, but developed pneumonia, and on August 2 he died from cerebral apoplexy. Public funeral services were held in the rotunda of the Capitol on August 8, and burial was at Marion, Ohio. An elaborate memorial to Harding has been built at Marion, and his home there has been made into a museum. See DISARMAMENT.

F. M.

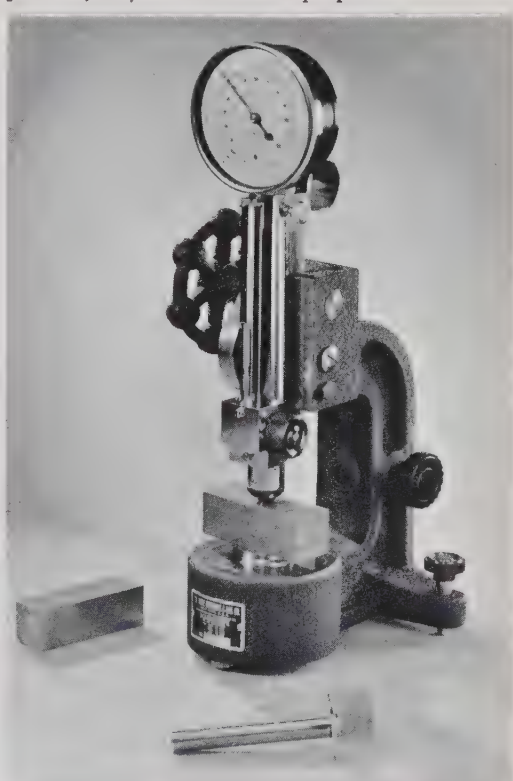
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**HARDING COLLEGE.** See COLLEGES.

**HARDNESS** is the resistance of a body to penetration due to the cohesion of its surface particles. Measurement of this quality is of especial importance in mineralogy and metallurgy.

**Mineralogy.** The *Scale of Hardness* is based on the resistance of a smooth mineral surface to abrasion. The following series was selected by Mohs as substances of definite comparative hardness: (1) talc; (2) gypsum; (3) calcite; (4) fluorite; (5) apatite; (6) orthoclase; (7) quartz; (8) topaz; (9) corundum; (10) diamond. In this scale each member will scratch all those which have lower numbers, and will be scratched only by those which have higher numbers. The numbers in the scale do not represent exact quantitative relationships. The difference in hardness between any two successive members in the scale is not a constant value, and therefore a mineral with a hardness of 6 is not necessarily exactly twice as hard as one with a hardness of 3. The greatest difference between a successive pair of minerals in the Mohs scale is that between corundum (9) and diamond (10). The test for hardness is only approximate, and is best made by selecting pure crystals, or cleavage fragments, with bright, smooth faces. The hardness of a

mineral may be judged approximately by means of very simple tools. Thus, minerals of hardness 1 or 2 are readily marked by the fingernail. Those having a hardness of 3 scratch and are scratched by a copper coin. Minerals of hardness 3, 4, or 5 are readily scratched by a knife blade, and those of hardness 7 or higher easily scratch glass. Minerals which cannot be scratched with a splinter of quartz or a hard steel file are rare, and are often used as precious stones. For most rock-forming minerals the hardness is generally tested by the effect of a good knife blade or a small file. Minerals may differ in hardness on different faces of their crystals and on the same face in different directions. More refined methods can test these differences, and the *sclerometer*, an instrument in which a small point of steel or of diamond is drawn across the surface under a definite pressure, may be used for this purpose. E. M. W.



SHORE INSTRUMENT & MFG. CO.

#### Instrument used in scleroscope hardness test

**Metallurgy.** Tests of hardness are based on the resistance of materials placed under load to plastic deformation by indentation. They are performed by impressing a hardened steel ball of standard size or a cone- or pyramid-shaped diamond of standard dimension under a standard load for a definite length of time on a prepared test surface or piece. Some of the hardness tests follow.

**Brinell Test.** A hardened steel ball, 10 mm. in diameter is applied to a sample to be tested under a load of 500 kilogram (kg.) for soft materials or 3000 kg. for hard materials. The diameter of the impression made in the test piece is measured in mm. with a low powered microscope and is converted into a Brinell hardness number from a Brinell conversion chart.

**Vicker Test.** In the Vicker test, the indenter or penetrator is a diamond, cut and polished to the shape of a square-based pyramid with an angle of 136° between pairs of opposite faces. The load applied to the indenter can be varied from 1 to 120 kg. and is applied automatically for about 10 secs. The diagonal

of the rectangular impression made in the test piece is measured with an optical micrometer. This value is then converted into a Vicker hardness number which is read from a Vicker conversion chart.

**Knoop Test.** The Knoop hardness test is performed in a manner similar to the Vicker test. The Knoop indenter is diamond, ground to a pyramidal form that produces a rhombohedral indentation having long and short diagonals of the ratio of 7.11 to 1. The included angles of the indenter are  $172^{\circ}-30'$  and  $130^{\circ}$ . The applied load can be varied from 25 to 3600 grams for a fixed period of time which is automatically controlled. An accurate and sensitive micrometer measuring microscope is used for measuring the indentation in the test piece which is ground and polished to a metallographic finish before testing. The measured length of the impression is then converted to a Knoop hardness number from a Knoop scale. The Knoop tester is known commercially as the Tukon tester.

**Rockwell Test.** This test is performed on a machine that measures hardness by determining the difference of the depth of penetration under a minor and a major load of steel ball or a spheroconical diamond point into the specimen under certain test conditions. The hardness is expressed as a number that is derived by subtracting this difference from an arbitrary constant.

The Superficial Rockwell test is similar to the regular Rockwell test but is used where shallow penetration is desired, as on thin sheet, or to determine surface hardness.

**Scleroscope Test.** In the scleroscope hardness test the height of rebound of a diamond-pointed hammer falling freely on the object under test from a fixed height is measured. The hardness number is read on a scale on the glass tube in which the hammer travels. To obtain reliable results the instrument must be held solidly, perpendicular or tangent to the test piece.

**Monotron Test.** In the monotron hardness test the hardness testing machine registers on a dial the load required to produce a definite penetration of the material being tested. Two indicating dial gages are used, one for measuring the applied pressure and the other for measuring the depth of penetration in both soft and hard materials. In performing the monotron test, penetration is first made in the test piece to a pre-determined standard depth by aid of a compensated depth micrometer indicator. The hardness number is then read from the pressure scale ordinarily in terms of kilograms per unit area while the load is still applied. In the monotron test a .75 mm. diameter hemispherical diamond impresser is used and it penetrates to a depth of .0018 inch.

Various processes are used for CASEHARDENING steel surfaces to definite hardness. J. E. FOSTER

**HARDWAR**, an ancient town, India, United Provinces, in the Saharanpur District, on the right bank of the Ganges at the mouth of the gorge through which the river issues from the Himalayas. Hardwar is a place of Hindu pilgrimage, and some 200,000 to 300,000 pilgrims come to bathe in the sacred spot each year at the beginning of the Hindu solar year (April-May). High in the upper wall of the bathing ghat is a stone on which appears the footprint of Vishnu, highly revered by the Hindus, as is the Temple of Gangadwara. Sanitary reforms in force since 1892 have made the sacred place healthful. Every 12th year a peculiarly sacred festival, attended by enormous crowds is held. An annual horse fair is also important. The main Ganges canal separates from the river here. Pop. (1941) 33,287.

**HARDWARE.** A term which includes a great variety of metal articles (steel, iron, brass, bronze, copper, and aluminum) and also glass, rubber, wood, and plastic merchandise. There are several classifications of hardware, which overlap in many instances, and which include builders', machinists', carpenters' and general household or domestic hardware.

When speaking of hardware one commonly thinks of bolts and nuts, screws, nails, locks, hinges and various hand tools (saws, hammers, pliers, axes, shovels, files, etc.) but this is merely a part of the hardware industry. Modern hardware, as sold by hardware retailers, includes such diversified objects as kitchen utensils, electric appliances, sporting goods (bats, balls, golf clubs, fishing equipment, etc.) rain-gutters, firearms, garden equipment (hose, sprinklers, lawn mowers, hoes, rakes, etc.) and, in rural sections, heavy farm implements and equipment. Plumbing supplies and fixtures of all types, chain, rope, wire, wire screening, "hardware cloth" (which is heavy, galvanized wire mesh used for protecting window glass, etc.), fencing materials, paints and brushes are also among the innumerable items making up the generic term, hardware.

**History.** The first hardware must have been the crude pottery, stone hammers, and flint weapons used by primitive man. Later, when the hardware trade was limited to those fittings used in house construction, it meant hinges, latches, etc.

The manufacture of hardware in America was first undertaken in New England, and this American colonial hardware, by 1790, included screws which were coming into general use in domestic architecture. By 1798 bolts and nuts were being manufactured. Door hinges were usually scrolled and often made of cast brass. Before screws came into use, these hinges were fastened with hand wrought iron nails, driven through a bit of leather to secure a binding fit. (Modern nails are machine-made, from wire.) Hardware of the 18th century, therefore, consisted of relatively few items, among which were hinges, nails, andirons of handwrought iron, door knockers of iron or brass, bolts, latches, weather vanes, and door (shoe) scrapers.

Wholesale hardware dealers of the middle 1800's handled about 2,000 items, mostly staple and heavy articles, while today over 100,000 separate items are listed in the catalogues of large hardware concerns.

The most important hardware items carried by the early dealer were horseshoes and horseshoe nails, stove pipe, copper (for bottoms of wash boilers) well buckets, muzzle-loading guns, etc. As recently as 35 years ago, at least one item out of every four sold in the hardware trade had to do with a horse, harness, wagon or buggy. About 40 years ago, considerable space in hardware stores was devoted to such articles as lamp goods and lanterns, wicks and lamp chimneys. Today, these items are almost forgotten pieces of hardware.

Until the latter half of the 19th century, the United States was almost wholly dependent upon England and Germany for hardware supplies. Quantity manufacturing of American hardware began about 1850, and today the American product is world famous for its standard of excellence. Large amounts of hardware of all types are exported to the countries of South America annually, in addition to that merchandise going to the European nations and the East.

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**HARDY, ALEXANDRE**, c. 1560-1631, French dramatist, was born in Paris. Attaching himself to a provincial theatrical company, he wrote for it about 600 pieces, some of which held the stage for 30 years. They were drawn from Spanish and Italian as well as from classical sources, and, while they have little or no literary merit, they contained much that pleased the audiences of the time. The best of them are *Didon* (1603); *Mariamne* (1610); *Le triomphe d'Amour* (1623). He published about 40 of them in 6 volumes (1624-28).



**HARDY, THOMAS**, 1840–1928, English novelist and poet, was born in Upper Bockhampton, Dorset, son of a mason and builder, a distant relative of Captain Hardy, commander of Admiral Nelson's flagship. Although he was apprenticed to an architect at 16 and made a reasonably good living in this profession until he was in his middle thirties, Hardy was not enthusiastic about his work and began to prepare himself for a literary career while still in his teens. Most of his first writings were verse (always his preferred literary form) inspired by his early disillusionment with the benevolent, Christian view of the universe, a disillusionment that was importantly influenced by the



Thomas Hardy

reading of Darwin and of iconoclastic theologians. Consistent rejection of his poetry led him to try fiction writing, but his first novel, *The Poor Man and the Lady* (part of which was posthumously published as *An Indiscretion in the Life of an Heiress*), was considered too "socialistic" for publication. His second try, *Desperate Remedies* (1871), a novel in the manner of the Wilkie Collins thriller, was printed, but it was not until the publication of *Far from the Madding Crowd* (1874) that he felt secure enough to marry Emma Lavinia Gifford and give up practicing architecture. During the next 21 years, he devoted himself to the series of novels that have since become known as the "Wessex Novels" because of their usual setting in the region that went by that name in King Alfred's time. Despite the geographical limitation of scene, these novels were generally more universal than the typical work of Victorian novelists because of Hardy's candid presentation of unsentimentalized human behavior and because Hardy always viewed his characters as exemplars of universal natural laws.

After *Jude the Obscure* (1895) was severely attacked for its frank treatment of sex and marriage, Hardy decided to devote himself entirely to poetry where he believed he could speak out to a more discriminating audience. However, up until the last years of his life when he became the "grand old man of English literature," he was subjected to periodic attacks of what his readers regarded as his pessimistic fatalism. Actually, Hardy was a meliorist in his belief that the world is slowly improving, although, since he became most readily vocal before tragedy, there was some justice on the side of those readers and critics who thought that he overemphasized the somber. Such novels as *Far from the Madding Crowd* (1874), *The Return of the Native* (1878), *The Mayor of Casterbridge* (1885), *Tess of the D'Urbervilles* (1891), and the once infamous, now famous, *Jude* (1895) seem securely entrenched against quick oblivion by the praise of competent critics. It is probable, however, that Hardy will be remembered longest for his magnificent philosophic epic, *The Dynasts* (1904–8), and for some of the shorter poems he published between his 58th and his 88th year. In these poems, particularly, he has memorably and distinctively given expression to a compassionate-ironical view of human existence that is completely original. HARVEY CURTIS WEBSTER

**BIBLIOG.**—C. J. Weber, *Hardy of Wessex* (1940); D. Cecil, *Hardy the Novelist* (1946); H. C. Webster, *On a Darkling Plain* (1947); A. J. Guerard, *Thomas Hardy* (1949).

**HARDY, Sir THOMAS MASTERMAN**, 1769–1839, English vice-admiral, was born in Somersetshire. He was present at the battle of the Nile (1798), was flag-captain to Nelson (1798–9), was with him at the Battle of Copenhagen in 1801, and was his constant companion until Nelson's death in his arms, at Trafalgar (1805). He played an important part in the War of 1812. See NELSON, HORATIO.

**HARDYNG, JOHN**, 1378–?1465, English chronicler. He entered the household of "Hotspur," whose death at Shrewsbury (1403) he witnessed; and also fought at Homildon (1402), and Agincourt (1415) with Sir R. Umfreville. His *Chronicle* from Brute to 1461, though valuable in some respects, is unreliable because of its different versions being adapted to the patrons to whom it was successively addressed.

**HARE**, a mammal of the family *Leporidae*, closely related to the RODENT. Hares are larger than rabbits and have longer ears and legs. They are vegetable feeders, eating grass, bark, and herbage. The young are born fully furred and with their eyes open. The adult does not construct a burrow but inhabits an ill-defined "nest" in the grass. American hares include the white-tailed jack rabbit, *Lepus campestris*; the varying hare or snowshoe rabbit, *L. americanus*; the arctic hare, *L. arcticus*; the black-tailed jack rabbit, *L. californicus*; and the pygmy hare, *Brachylagus idahoensis*. Hares furnish man with good food and a fur especially useful for felting. They are



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#### American varying hare, or snowshoe rabbit

the victims of the smaller carnivores, particularly in winter. See RABBIT.

**HARE AND HOUNDS**, a game popular at Rugby and since 1877 developed in England into an organized sport, with a recognized code of rules and many clubs for cross-country running. It is occasionally played in the United States, where in a few schools and athletic organizations it is a favorite sport. The exercise usually takes the form of a paper chase where the "hares" distribute bits of paper along their course. This the "hounds" must follow after giving the hares a suitable time to get well under way.

**HARE INDIANS**, North American aborigines, one of the main branches of the ATHABASCAN INDIANS, or Chippewayans, who are scattered in small groups along the banks of the Mackenzie, Anderson, and Macfarlane rivers, between the Great Bear Lake and the Eskimo domain. They are employed as trappers and voyageurs or assistants about the stations of the Hudson's Bay Company.

**HAREBELL**, or **BLUEBELL**, the popular name of the beautiful, slender-stemmed *Campanula rotundifolia*, whose solitary little drooping pale blue flowers are borne on the finest and most graceful of flower stalks. It flowers in late summer. The leaves which appear in summer, when the plant is in flower, are long and narrow; the specific name refers to the rounded leaves borne in winter and spring. The name harebell or hairbell is also sometimes applied to the wild HYACINTH or "bluebells" of English hedgerows.

**HARELIP**. See CLEFT PALATE AND HARELIP.

**HAREM**, literally the "forbidden" (Arabic), refers to that secluded portion of an Islamic household reserved for women. As a collective noun it also signifies the inmates of the quarter. Harems have co-existed with **POLYGAMY** as far back as the ancient Persian, Peruvian, and Babylonian civilizations. Because Islamism sanctioned polygamy, it is among the Moslem nations—Turkey, Persia, Arabia—that the institution attained maximum development. In India, harems have been established both by Moslems and Hindus.

The Koran allows each Mussulman four wives; caliphs and sultans may have nine. Since each marriage requires a heavy financial settlement by the husband, and since there is no limit to the number of concubines permitted, the harem, where it exists, generally consists of only one legal wife but a number of consorts. In the past, wealthy husbands spared no luxury or comfort for their harems. Each wife had her own apartment, her own body servants and slaves. However, lush surroundings could not compensate for abuses and severe restrictions.

Economic factors and the spread of Western ideals in India and Turkey since 1900 resulted in the gradual disappearance of the harem and the amelioration of the plight of harem women. In 1945 a congress of women from seven Middle Eastern Arab nations voted a resolution for the abolition of polygamous practices among the poorer classes. See **CONCUBINAGE**.

MELVIN ALTSHULER

**HARFLEUR**, former harbor, France, in the department of Seine-Inférieure, on an estuary of the Seine, five miles SE of Le Havre, which supplanted it as a harbor when the river became silted. During the Hundred Years' War Harfleur was the chief harbor on the French coast of the Channel. In 1415 it was taken by the English under **HENRY V**. It was invested in the following year by the French, who were defeated by a fleet under John, Duke of Bedford, and others. The English lost the town on Nov. 4, 1435. Pop. about 4,300.

**HARGREAVES, JAMES**, d. 1778, British artisan and inventor, was born near Blackburn, England. He became a carpenter and handloom weaver and about 1764 invented the spinning jenny. It met an urgent need in that it enabled the spinner to keep pace with the weaver, whose productive pace had been stepped up by use of the fly-shuttle invented by **JOHN KAY**. For thus upsetting old methods Hargreaves was mobbed by his fellow workmen (1768). In 1770 he moved to Nottingham, where he took out a patent on his invention, but this patent was frequently infringed upon by unscrupulous cotton and woolen manufacturers. See **INDUSTRIAL REVOLUTION**.

**HARI RIVER**, rises in central Afghanistan on the W slopes of Koh-i-Baba, flows W for about 650 miles through Afghanistan just S of Herat, then N for a space separating Afghanistan from Iran and, farther N, Iran from the Soviet republic of Turkmen, then loses itself in the Tedzhen oasis of Turkmen.

**HARICOT**. See **BEAN**.

**HARIMUKOTAN ISLAND**. See **KURIL ISLANDS**.

**HÄRING, GEORG WILHELM HEINRICH**, 1798–1871, German novelist, whose pen name was Willibald Alexis, was born in Breslau. His first success was won in 1823, with an historical romance, *Walladmor*, purporting to be an unpublished work of Sir Walter Scott. It was translated into English by De Quincey (1824), and praised by Sir Walter himself. The same pretense was kept up in two more novels, *Die Geächteten* (1825) and *Schloss Avalon* (1827), but was afterward dropped. He wrote several other novels, of which *Cabanis* (6 vols. 1832), an historical tale of Prussia, is the most ambitious.

**HARIRI, ABU MOHAMMED AL KASIM IBN ALI, AL-**, 1054–1121, Arabic author surnamed Al-Hariri ("the silk merchant"), was born in Basrah, on the Shat-el-Arab. His life was devoted to literary pursuits and studies. The most famous of his com-

positions was *Makamat*, a collection of tales in rhyme, which are unrivaled in Arabic literature for brilliancy of imagination and wit. The thread of plot holding the 50 episodes together are the antics of Abu Zaid, a rascal who roves over the countryside earning his way with humorous stories. This book is regarded in the East as second only to the Koran.

**HARKINS, WILLIAM DRAPER**, 1873–1951, American chemist and nuclear physicist, was born in Titusville, Pa., and studied at Stanford University and the Institute for Physical Chemistry in Karlsruhe, Germany. He taught chemistry at the University of Montana (1900–1912) and the University of Chicago, where he became Andrew MacLeish professor in 1935. He received the Willard Gibbs medal in 1928.

Harkins was noted for his theories on nuclear composition and the stability and transmutation of elements. As early as 1915 he suggested the hydrogen helium reaction of the **HYDROGEN BOMB**. In 1920 he was among the first to suggest the existence of the "neutron," introducing the word in 1921. He was especially noted for his photographs using the Wilson cloud chamber, which showed both the building and disintegration of atoms. During World War II, Harkins was a government consultant on the chemistry of rubber manufacture. A pioneer student of the distribution of the elements, he was a proponent of the "magic number" theory.

**HARKNESS, EDWARD STEPHEN**, 1874–1940, American philanthropist, was born in Cleveland, Ohio, and studied at Yale University. Inheriting estates from his father, mother, and brother based on Standard Oil Company stock, he gave away an estimated \$100,000,000 during his life. He sponsored medical research and social work, helped develop the Oxford system in American universities, and contributed large sums to Yale, Harvard, and Columbia universities, Phillips Exeter Academy, and the Metropolitan Museum of Art.

**HARLAN, JAMES**, 1820–99, American political leader, was born in Clark County, Ill. After 1845, he went to Iowa, becoming principal of Iowa City College and later of Iowa Conference University (1853–55). He was elected to the Senate (1855) on the new Free-soil party ticket and again in 1860. Appointed secretary of interior in Lincoln's cabinet (1864), he created bitter enemies. In his service under Johnson, Harlan opposed his reconstruction policies and resigned from the cabinet in 1866. Elected to the Senate (1866), he supported Johnson's impeachment. Harlan retired from public life in 1872.

**HARLAN, JOHN MARSHALL**, 1833–1911, American jurist, was born in Boyle County, Kentucky. He was educated at Centre College (1850), and subsequently took up the study and practice of law. In 1861 he recruited and organized the 10th Kentucky Regiment, of which he was colonel until 1863. He then became attorney general of Kentucky, holding this office till 1867, when he moved to Louisville. He was twice a candidate for the Republican Kentucky gubernatorial nomination (1871 and 1875), and was a candidate for the vice-presidential nomination (1872). In 1877 he became an associate justice of the U.S. Supreme Court; in 1889, professor of law in George Washington University. He was a member of the Bering Sea Tribunal of Arbitration in 1893.

**HARLAN**, city, SE Kentucky, county seat of Harlan County, in the Cumberland Mountains near the Virginia border; at the confluence of three forks of the Cumberland River; on the Louisville and Nashville Railroad and U.S. Highway 119, about 110 miles NE of Knoxville, Tenn. Harlan was founded in 1819 by Virginians under the leadership of Samuel Hoard. First called Mount Pleasant, it was later renamed to honor Maj. Silas Harlan who was killed in border warfare. Since the arrival of the railroad in 1911, Harlan has become an important shipping point for lumber and the mining of bituminous and cannel coal. Harlan has been the scene of



bitter struggles between coal mine operators and workers; in 1931 several miners were killed when both sides resorted to violence. Pop. (1950) 4,786.

**HARLAND, HENRY**, 1861–1905, American novelist, was born in New York City. He was educated at the College of the City of New York and at Harvard. His early novels, melodramatic stories of Jewish immigrants in New York, were written under the pseudonym of Sidney Luska. His later years were largely spent in London, where he wrote his most popular novels, *The Cardinal's Snuff Box* (1900) and *My Friend Prospero* (1904), and, with AUBREY BEARDSLEY, edited the *Yellow Book* (1894–97).

BIBLIOG.—Albert Parry, *Garrets and Pretenders* (1933).

**HARLAND, MARION**. See TERHUNE, MARY VIRGINIA.

**HARLECH**, town, Britain, on the W coast of Wales, ancient capital of Merionethshire, at the N curve of Cardigan Bay; 10 miles N of Barmouth. Its 14th-century Norman fortress-castle held out against the Yorkists until 1468, when it was forced to surrender. This siege is said to have inspired the Welsh national air, *Men of Harlech*. Pop. about 1,000.

**HARLEIAN MANUSCRIPTS**, a collection made by ROBERT HARLEY, Earl of Oxford, and by Edward, his son. It consists of 8,000 MSS., 50,000 printed books, and 400,000 pamphlets. The collection is rich in illuminated MSS. relating to civil and religious history, copies of the classics—containing the earliest known copy of the *Odyssey*—and of early English poetry. A large part of the collection was purchased by the British government for \$50,000 in 1753, and is now in the British Museum.

**HARLEM** is a section of the borough of Manhattan in New York City, N.Y.; bounded on the S and W by E 96th Street and 110th Street, on the N by 155th Street, on the E by the Harlem and East rivers, and on the W by Central Park along Fifth Avenue and by Morningside and St. Nicholas avenues N of Central Park. Established in 1658, this community was about 10 miles north of the main village of New Amsterdam. In the later part of its history the land was partitioned and the neighborhood became one of the more fashionable suburbs. By 1910 the white population began to move out of the district and during and after World War I the Negroes, Latin Americans, and Italians became firmly entrenched there. In the 1940's, a large Puerto Rican settlement developed in the area.

**Negro Harlem**. The Negro section houses about 500,000 colored people, many of whom came to the city in search of industrial jobs during World Wars I and II. Rents are about 50% higher than for comparable places for white people. Thus more than one family usually lives in one apartment to lessen costs and, as a result, overcrowding and disease exist.

Within the Negro section itself are various subdivisions such as "Sugar Hill," a fine residential district in the northwest corner; the "Golden Edge," a neighborhood along Central Park where professional people live; and a slum area to the east, known as the "Valley." The main business and shopping areas are along Seventh Avenue, 125th Street, and the Lenox Avenue made well known in the "Amos and Andy" skits and popular jazz songs. To try to ease the overcrowding and unhealthy atmosphere in most Harlem homes, John D. Rockefeller financed the building of the Paul Lawrence Dunbar Apartments, and the Federal government provided over \$4,000,000 in funds



BRITISH INFORMATION SERVICES

### Norman fortress-castle of Harlech, famed in legend and song

for the Harlem River Houses in 1937 to make suitable housing available for low-income groups.

For white people looking for amusement, Harlem is a source of out-of-the-way night spots such as those down "Jungle Alley" (133rd Street). Famous night clubs of the past in this district were Connie's Inn and the Cotton Club, but now most of the large establishments featuring Negro entertainment have moved farther downtown, leaving the Savoy Ballroom and the Apollo Theatre the strongholds of orchestras and dance bands in Harlem.

The Negroes in Harlem have their own cultural and religious centers which include an art center, the Lafayette Theatre for Negro dramatic productions, a Y.M.C.A., public library branches, hospitals and health centers, their newspapers the *Amsterdam News* and the *New York Age*, and there are many large and small religious groups and churches. The largest church is the Abyssinian Baptist Church where A. Clayton Powell was the pastor before he became congressman for this district. The most publicized religious center is the Kingdom of Father Divine. See NEGRO; NEW YORK (City).

BIBLIOG.—Federal Writers Project, *New York City Guide* (1939).

**HARLEM HEIGHTS, BATTLE OF**, a minor engagement of the Revolutionary War fought Sept. 16, 1776, during the New York campaign. After his defeat at the Battle of LONG ISLAND Washington retired to the upper end of Manhattan Island; he established his line from the mouth of the Harlem River to Harlem Heights. When the British began their attack, Washington sent detachments under Col. Thomas Knowlton and Maj. Andrew Leitch to attack the enemy from the rear; the British were repulsed with a loss of 70 killed and 200 wounded. The Americans lost 80 killed and wounded; included among the mortally wounded were both Knowlton and Leitch. This was a minor victory, but it greatly enheartened the Americans, whose morale had previously been very low with large-scale desertions. General Howe remained inactive for a month before continuing his campaign against Washington. See WASHINGTON, GEORGE; REVOLUTION, AMERICAN.

**HARLEM RIVER**, New York, together with Spuyten Duyvil Creek, separates Manhattan Island from the mainland to the E and N. It is navigable, and with a short ship canal provides a waterway between the Hudson and East rivers. High, Washington, and other bridges cross it. See NEW YORK, city.

**HARLEQUIN**, a survival from Greek and Roman comedy. The medieval Italian *arlecchino* was equivalent

lent to the English clown. The harlequinade is—or rather was, for it is now practically 'obsolete—a pantomime performance acted in dumb show. The business of Harlequin is to protect Columbine against the intrigues of Pantaloon and Clown. See PANTOMIME.

**HARLEQUIN DUCK**, a handsome species of duck which inhabits eastern Asia and northern North America. In winter it flies as far south in the United States as Maine on the Atlantic coast and California on the Pacific coast. The harlequin duck, *Histrionicus histrionicus*, is about 17 inches long. Males are a dark bluish-slate color with black and white head markings; females are dark brown above and grayish-brown below. Both have short bills, long tails, and small crests. This duck is a popular game bird.

**HARLEQUIN SNAKE**. See CORAL SNAKE.

**HARLEY, ROBERT**, 1st **EARL OF OXFORD** and **EARL OF MORTIMER**, 1661–1724, English statesman, born in London and elected to Parliament as a Whig (1690); he later became a Tory leader. He was speaker of the Commons (1701–5), and a secretary of state (1704). Harley influenced Queen Anne through his cousin, Abigail Masham (later Lady Masham), against the Whig ministers, Marlborough and Godolphin, who caused his resignation in 1708. In 1710 Godolphin was dismissed and with Harley appointed chancellor of the exchequer, the Tories came into power. His popularity was greatly increased when he was wounded (1711) by the Frenchman known as Marquis de Guiscard; Parliament named him earl of Oxford and Mortimer and lord high treasurer. His principal achievement was the Treaty of Utrecht (1713) at the close of the War of the Spanish Succession. After quarreling with Lady Masham, Harley lost the queen's favor to Viscount Bolingbroke and was dismissed (1714). The power of the Tories ended when George I ascended the throne (1714) and Harley was tried for his peace negotiation tactics but released as a result of a technical disagreement. His books and manuscripts to which his son added form the Harleian Collection in the British Museum. See HARLEIAN MANUSCRIPTS.

**HARLINGEN**, city, S Texas, Cameron County, on the Missouri Pacific and the Southern Pacific railroads, and U. S. Highway 83 about 120 miles SSW of Corpus Christi. Established in 1904 during the colonization of the lower Rio Grande Valley, it developed as the commercial center of an extensive irrigation project. Great quantities of garden vegetables and citrus fruits are shipped from the valley lands. The city has a cotton compress, and its factories produce cotton oil, machinery, preserved foods, meat and dairy products, chemicals, fertilizers, concrete, and sheet metal. Pop. (1950) 23,229.

**HARMAR, JOSIAH**, 1753–1813, American soldier, was born in Philadelphia. He served under Washington in the North (1776–80) and under Greene in the South (1781–82). In 1785 he was made commander of the forces on the Ohio River; two years later he was brevetted brigadier general. In 1790 he led a poorly disciplined force of militia against the Indians of present Ohio and Indiana; his expedition was a failure since the Indian depredations continued. He resigned from the service in 1792.

**HARMAR, FORT**, a military post built in the winter of 1785–6 on the west bank of the Muskingum River at its junction with the Ohio, by Major John Doughty, and named for his superior Colonel (later General) JOSIAH HARMAR, who occupied it later for a time. The fort gave protection to the settlers of Marietta, which was founded on April 7, 1788. Here two important Indian treaties were drawn up on Jan. 9, 1789, one with the Iroquois, the other with several western tribes. After the Treaty of Greenville, which followed Gen. ANTHONY WAYNE's victory at the Battle of FALLEN TIMBERS, the troops were withdrawn as no longer needed for protection against the Indians.

BEATRICE WHITACRE

**HARMATTAN**, the hot east wind blowing from the interior of Guinea to the Atlantic Ocean. Coming off the desert, it is laden with clouds of reddish dust, which has been known to cover the sails and decks of ships at a distance of 700 miles from shore. It blows at intervals during December, January, and February, continuing from one to fifteen days, and is felt as far south as Sierra Leone and Cape Palmas.

**HARMODIUS AND ARISTOGITON**, devoted Athenian friends who in 514 B.C. formed a conspiracy to slay the tyrants Hipparchus and Hippas, brothers, and apparently joint rulers of Athens. In a premature attack Hipparchus was killed and Harmodius was slain by the guard. Aristogiton escaped, but was captured and put to death by torture. When Hippas was driven from Athens, four years later, Harmodius and Aristogiton were acclaimed martyred heroes.

**HARMON, JUDSON**, 1846–1927, American jurist, born in Newtown, Ohio. Until 21 years old he remained on the home farm. He studied at Denison University and the Cincinnati Law School, and entered the law office of George Hoadly, afterward governor of Ohio. In 1872 he managed the Greeley campaign in Cincinnati; in 1876 became judge of the Ohio Court of Common Pleas; and in 1878, judge of the Superior Court. He was attorney general in President Cleveland's cabinet (1895–97). Later he was governor of Ohio.

**HARMON, THOMAS DUDLEY**, known as **Tom**, 1919–, American football player, was born in Rensselaer, Ind. An outstanding ball carrier, he was named All American halfback in 1939 and 1940 while playing with the University of Michigan. In World War II, Harmon, an aviator, was twice missing in action after plane crashes. He entered professional football after the war and later became a sports announcer. He wrote *Pilots Also Pray* (1945).

**HARMONIC LAW**. See KEPLER'S LAWS.

**HARMONIC MEAN**,  $H$ , of a set of  $N$  positive numbers  $x_1, x_2, \dots, x_N$  is calculated from the formula that defines  $H$ , viz.,

$$\frac{1}{H} = \left( \frac{1}{x_1} + \frac{1}{x_2} + \dots + \frac{1}{x_N} \right) / N = \sum \left( \frac{1}{x_i} \right) / N$$

where  $\Sigma$ , the Greek capital *sigma*, stands for the "sum of all terms of the kind indicated" and the subscript  $i$  is understood to be any of the subscripts from 1 to  $N$ . In words: the harmonic mean of a set of positive numbers is defined as the reciprocal of the arithmetic mean of the reciprocals of the numbers (see AVERAGE). From the formula it is found that the harmonic mean of two numbers,  $a$  and  $b$ , is  $H = 2ab/(a+b)$ . Harmonic means are used in averaging certain ratios such as prices and rates. For example, if apples are bought on three occasions at the prices 3 for 25¢, 5 for 25¢, and 6 for 25¢, the average price for the 14 apples is found from  $1/H = (1/3 + 1/5 + 1/6)/3 = 7/30$ ; whence  $H = 4\frac{2}{7}$  apples for 25¢. The same result is obtained by first finding the price per apple for each purchase, then the arithmetic average of these prices, which is the average price per apple, and finally the number of apples for 25¢. For the relationships between arithmetic, geometric, and harmonic averages, see MEAN.

A. T. M.

**HARMONIC MOTION**, the general name given to a reciprocating motion like that of a piston or a pendulum. Harmonic motions are classified either as simple, with only one frequency and amplitude, or complex with two or more simple components. In the case of simple harmonic motion, the acceleration is always toward the origin and directly proportional to the distance from it, with the range extending to equal distances on both sides. The foregoing follows from Hooke's Law in the case of elastic bodies as the force tending to restore the deformed body is proportional to the deformation. Simple harmonic motion is defined geometrically as the projection of uniform circular motion on a



diameter. It is the basis of the theory of vibrations and of wave motion. Periodic oscillations, such as the vibrations of a string in producing a musical note, can be analyzed and investigated by the laws of harmonic motion.

If  $P$  (Fig. 1) moves uniformly round the circle  $APB$ ,  $R$ , the foot of the perpendicular from  $P$  on the diameter

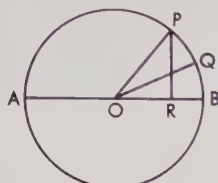


Fig. 1

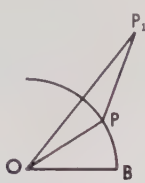


Fig. 2

$AOB$ , has a simple harmonic motion. If  $x$  represents the distance of  $R$  from the center  $O$  at any time  $t$ ,  $x = a \cos(\omega t + \beta)$ ,  $a$  being the amplitude of the movement—i.e.,  $OB$ ,  $\beta$  the epoch, or the angular distance  $BOQ$  of the point  $Q$  from which the motion is reckoned, and  $\omega$  the angular velocity of  $P$ . The angle  $BOQ$ , marking the position of  $P$ , is called the phase. The first and second differentials of  $x$  with respect to  $t$  give the velocity and acceleration of  $R$ . In many self-registering instruments the indicator pencil moves transversely across a ribbon of paper, which has a motion at right angles to its own, so that the path of  $R$  is drawn as an undulating curve, known as the curve of sines. Such is the form produced by the simple vibration of a string, and by simple ripples on a water surface.

Two or more simple harmonic motions in the same line, if they have the same period, will be equivalent to a single motion of the same period. For if  $P_1$  (Fig. 2) revolves round  $P$  with the same velocity as  $P$  round  $O$ , the angle  $OPP_1$  will remain constant, and the triangle  $OPP_1$  will retain its form, so that  $P_1$  will revolve around  $O$  in the same period. If the phases be alike—i.e., if  $OPP_1$  equals  $180^\circ$ —the resultant amplitude is the sum of the component amplitudes; and if  $OPP_1 = 0^\circ$ , it is the difference of the components. If the periods be unequal, the triangle  $OPP_1$  will continually change its form, and will not return to the original form until one of the points  $P$  and  $P_1$  has made exactly one more revolution than the other, or after a time  $2\pi(\omega - \omega_1)$ . This combination of motions is illustrated by the tides. See **TIDE**.

Harmonic motions in different directions may also be combined. We may, for example, reproduce the original circular motion by combining with the given harmonic motion another of equal amplitude and period at right angles to it. Generally, two harmonic motions of the same period, but of different amplitudes, directions, and phases, combine to form elliptic motion between the extremes of the straight line and the circle. If the periods are nearly but not quite equal, the path is approximately elliptical. When the periods are distinctly unequal, the paths can be traced only by points, except when they are in a simple ratio, as when one period is double the other, in which case the path continually changes from a figure 8 to a part of a parabola and back again.

**HARMONIC PROGRESSION.** See **SERIES**.

**HARMONICA**, a musical instrument improved by BENJAMIN FRANKLIN, on which the sounds are produced by friction of wet fingers on basins made of glass. A keyboard was later added. The instrument was popular in Germany and Austria, and Mozart and Beethoven wrote music for it. Still another type, played with a mallet, had bars of glass or metal placed in a row. See **MUSICAL GLASSES**.

The mouth harmonica, or mouth organ, developed in 1829 by Sir CHARLES WHEATSTONE, is a small, flat case of wood or metal, on the oblong side of which are perforations leading to metal reeds inside. It is

played by inhaling or exhaling through the perforations. There are numerous harmonica bands, as well as several concert artists, among whom are Larry Adler and John Sebastian.

**HARMONISTS.** See **HARMONY SOCIETY**; **COMMUNISTIC SETTLEMENTS**.

**HARMONIUM.** See **ORGAN**.

**HARMONY.** Though derived from a Greek word meaning a *fitting* or *joining*, the practice of combining musical sounds of different pitch into chords and arranging such chords in what seem to us natural and orderly progressions is a comparatively modern art and by no means a universal one, except insofar as Western ideas and practices have spread and carried their influence.

A musical tone is produced by regular vibrations of a sounding body, its pitch being determined by the rapidity of the vibrations. An interval is the difference in pitch between two tones, and a chord, in the widest definition, is a combination of two or more intervals.

The ancient Greeks knew the various intervals and classified them as consonant (smooth, restful) and dissonant (rough, restless, requiring resolution), but in their music they used intervals only successively, i.e. melodically, and not simultaneously in any systematic way. They did, however, relish a process called *magadizing* which consisted in doubling their melodies at the distance of the octave, feeling as is now felt the practical identity of notes an octave apart. They had also discovered the overtone series, the upper partials which sound along with any fundamental tone, determining its sonority, brilliance, and timber.

**Early Development.** The history of the early development of harmony may be traced in the gradual awakening to the pleasurable effect of combining higher and higher members of the overtone series. The ancient Greeks sang in parallel octaves. By the time of the 10th century, a Flemish monk named Hucbald describes a process called *Organum* or *Diaphony* which consisted in adding the intervals of parallel fourths or fifths as well as octaves above, below, or around a given melody. In the 13th century, Franco of Cologne recommended mixing the imperfect consonances of major and minor thirds with the perfect fifths and fourths, a system called *Discant*. Sixths were still classified as dissonant, but their use was more and more countenanced, so that by the next century, Jean de Muris admitted the major sixth to the list of imperfect consonances. But as the sixths rose in favor, the perfect fourth declined; strangely enough, its exact status as a consonance or dissonance is in dispute even today. At least, this was the beginning of the realization of the harmonic poverty of the perfect intervals, which eventually resulted in a complete reversal of early practices.

With later *discant* in three or more parts came the use of what were eventually to be recognized as complete triads (three note chords made up of a third and a fifth above the root tone). But the development of harmony was held in check as long as habits of thinking were bound to the idea of combining consonant intervals, rather than accepting these combinations as units of sound, or chords.

This was the basis of harmonic thinking through the time of PALESTRINA, the Golden Age of COUNTER-POINT.

These combinations of consonant intervals resulted from the natural melodic flow of voices, moving often in imitation of each other. There were devices which added great variety and interest to this flow of basic consonance. One was the use of passing and auxiliary notes as embellishments. Another was the delaying of one or even two of the voices in going from one concord to the next, thus producing a temporary dissonance known as suspension. But these dissonances were always transient, or as could be said, unessential.

**Modal Scale System.** There was still another

barrier to harmonic thinking: namely, the scale system of the modes which had been derived through confusion and numerous permutations from the ancient Greeks. (See *MODE.*) Each mode had a step known as the Final (corresponding to our Tonic) and another step called the Dominant (usually the fifth step as in our system), but these steps were not thought of as being the root tones of triads. In modal thinking all consonant combinations were of equal importance, each being merely the result of an accidental conjunction of melodies. The combination at a close or cadence point had a temporary importance, but these cadences were constantly shifting, giving to modern listeners a feeling of tonal insecurity and often of pleasant surprise and of great flexibility.

But certain practices were at work undermining the original differences between the modes; these were a set of rules governing the use of accidentals, and were known as *Musica Ficta*. For example, the minor triad, not being a natural product of the overtone series as is the major, was, in the minds of medieval musicians, lacking in the quality of finality. An accidental was therefore employed to raise the third (the so-called *Tierce de Picardie*) in the final chords of nearly half the modes (see last chord of Ex. 4). The raising of the seventh steps of certain modes (C-sharp in Ex. 4), and the use of B-flat to avoid the awkward interval of the augmented fourth or Tritone (see first bass tone, second bar, of Ex. 4) did even more to break down the differences between the modes, and eventually brought the realization of the overshadowing importance of the Ionian mode, which corresponds to our major scale. And with the realization of the greater importance of accidental harmonies over others in establishing a tonality came the new concept of shifting from one tonality to another, a process now called modulation.

**17th Century Experiments.** These developments are discernible in the works of composers of the early 17th century, among them Peri, composer of the first opera; CACCINI, inventor of the Recitative; Viadana, the first user of Basso Continuo, a system of indicating chords with figures under the bass; and most gifted of all, MONTEVERDI, daring experimenter in new harmonies, whose most significant contribution was his use of the dominant seventh as a chord, i.e., not as a prepared suspension or a passing combination (as at the passing tone in Ex. 4), but as an essential dissonance. (A seventh chord is formed by superimposing another third on top of a triad.)

### Ex. 1. The Overtone Series:

Intervals derived therefrom:

Ex. 1 shows the overtone series starting on C. The notes are C (1), G (2), C (3), E (4), G (5), Bb (6), C (7), D (8), E (9), F (10). Above the notes, intervals are labeled: Maj. 3rd (C-E), Min. 3rd (C-G), Maj. 6th (C-F), Min. 6th (C-Bb), 2nd (C-D), and 7th (C-E). Below the notes, intervals are labeled: Octave (C-C), 5th (C-G), 4th (C-E), 3rd (C-Bb), 2nd (C-D), and 1st (C-C).

### Ex. 2. Organum:

Discant:

Ex. 2 shows Organum and Discant. The Organum part consists of a series of dyads (two notes) in the right hand and single notes in the left hand. The Discant part consists of a series of dyads in the right hand and single notes in the left hand. Above the Discant part, 'x' marks indicate complete triads.

At x occur complete triads.

### Ex. 3. Combinations of consonant intervals:

Ex. 3 shows combinations of consonant intervals. The top part is labeled 'Old analysis:' and shows three dyads: Maj. 3rd and Perf. 5th, Min. 3rd and Perf. 5th, and Major and minor 3rds and 6ths combined. The bottom part is labeled 'Later analysis:' and shows three dyads: Major triad, Minor triad, and Triads in first inversion.

### Ex. 4. Embellishments of basic consonance:

Ex. 4 shows embellishments of basic consonance. The top part is labeled 'The basic consonance.' and shows a series of dyads. The bottom part shows a series of dyads with embellishments: auxiliary (a), passing tone (p), and suspension (s).

a=auxiliary; p=passing tone; s=suspension.

### Ex. 5. Modulation

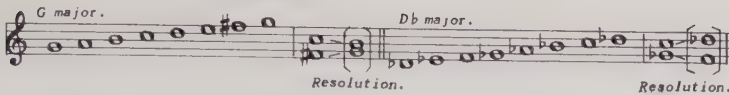
Ex. 5 shows modulation. The top part is labeled 'Cadence in C.' and shows a series of dyads. The bottom part is labeled 'Cadence in A.' and shows a series of dyads. Below the bottom part, figures of A. are shown: I, IV, V, I, II IV, V, I.

It must be admitted that, exciting as these experiments and discoveries were at the time, they were too much for several generations of composers to digest. It took the towering genius of BACH to fuse them with the older polyphonic practices. In his works the harmonies still seem to be the results of moving voices, but they are richer, wonderful harmonies, and as a matter of fact, the melodies were often the outgrowth of preconceived underlying chords and progressions.

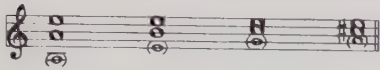
The possibilities of modulation, at least in instrumental music, were also vastly extended for Bach by his adoption of the principle of equal temperament—a division of the octave into twelve equal semitones, throwing certain notes slightly out of tune so that all



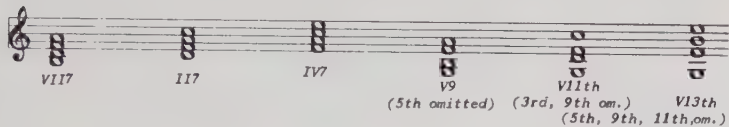
## Ex. 6. Enharmonic change:



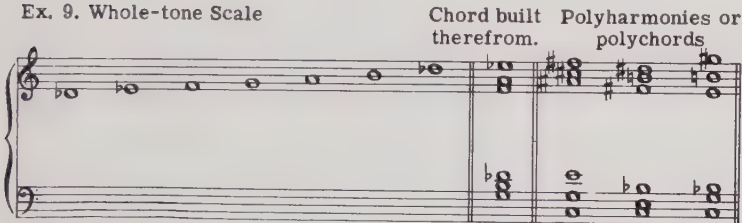
## Ex. 7. Resultant Tones: (Tartini Tones)



## Ex. 8. Seventh, Ninth, Eleventh and Thirteenth Chords.



## Ex. 9. Whole-tone Scale



would be sufficiently in tune to be usable in any key. This brought with it the concept of enharmonic change, according to which any pitch can be thought not in one but in several significations. It is a commonplace to us that F-sharp and G-flat sound alike, but a musician can make them affect us as differently as do the words "blue" and "blew" which also sound alike. If the scales of Ex. 6 are played, followed in each case by the identical interval F-sharp (or G flat) to C, the difference can be felt.

Bach exemplified his theories in his music, but there were also at this period, theorists who were attempting to account for existing practices. Outstanding among these was Rameau who wrote from 1722 to 1753 and whose outstanding contribution was the idea of inversions of chords (see Ex. 3). Tartini, a violinist and composer of the time, discovered what were long called after him "Tartini tones," later named resultant tones, which can be clearly heard when double stopping or tuning a violin.

Harmonic developments and usage during the Classic and Romantic periods form the basis of most harmony text books available today. To these a reader must be referred since a full and adequate exposition of the subject is impossible in a limited space. However, a few more observations and some warnings are necessary.

**Changing Conceptions.** It will be seen from the sketch so far, that the history of the development of harmony is a series of changing conceptions about the stuff of which music is made. These conceptions continued to expand throughout the periods mentioned, during the Classical period especially in regard to what constituted good and usable key relationships.

During the Romantic period, music under the hands of WAGNER and FRANCK grew more and more chromatic, which resulted in a multiplication of the number of chords through alterations of previously existing harmonies, and also a multiplication of the number of possible progressions.

Another prolific source of new harmonies was the passing notes and suspensions mentioned before. Just as in Monteverdi's time the dominant seventh became accepted as an essential harmony, so in succeeding generations, other seventh chords and the dominant ninth and so-called eleventh and thirteenth chords passed from the status of transient effects to accepted units of sound, the unessential of one age becoming the essential of the next. Likewise what is startling, new, and exceptional in one age becomes the accepted and conventional in the next.

It must therefore be understood that the subject of harmony is not fixed, circumscribed, or in any sense complete, nor can it be so long as our music continues to expand its vocabulary and change its usage, which it must and will continue to do so long as it is a living language, a medium for the expression of human imagination, fantasy, and aspiration. Unfortunately the writers of harmony texts have not always been careful to present the subject in this light. Numerous existing books speak of a body of "basic laws" and "fundamental rules" of harmony, as if these had existed since the beginning of time, when all that is under discussion is, to borrow a term from Walter Piston's book, the "common practice" of the best composers of the not too distant past. The only basic laws, so far as harmony is concerned, are those of the science of sound or acoustics. Most of the so-called fundamental rules of harmony, such as the prohibition of parallel perfect fifths and octaves, are the result of certain premises upon which the customary teaching of harmony are based—namely, writing in a certain number of independent voices or parts (usually four). DEBUSSY, for example, loved to shock his teachers by writing chords in similar motion, thus producing parallel fifths. The teachers said he was breaking a fundamental rule. But Debussy was not writing in parts; the rule was not applicable.

Since the study of harmony is the result of the observation of past musical practice, it tends to lag behind actual musical composition by a generation or more. Composition being an art and not a science, the serious composer of any period works intuitively, often prophetically. Debussy's use of the whole-tone scale furnishes an example; he used it sensitively, but his manner of notation shows that he did not stop to reason out its relation to normal tonality. This relation can now be clearly traced. The observation has also been made that this phenomenon is not so much a scale as a chord.

The terms Polyharmony and Polytonality crop up frequently in present day music. The former occurs when different chords are sounded simultaneously. The latter is the result of using different keys simultaneously in different registers or with different tone colors. This may seem arbitrary and cacophonous, but like most modern devices, it has its roots deep in the past and has been long evolving; when well handled, the effect can be delightful indeed.

Among the composers of today, two have written significantly expounding their harmonic theories. SCHÖNBERG has advocated building chords in fourths

rather than thirds. More important, he began composing in the Twelve-Tone system which he evolved—an attempt to find a unifying principle to govern musical composition when the accepted notions of major and minor tonality are rejected.

HINDEMITH, in his book *Craft of Musical Composition* (1945), likewise rejects conventional habits of constructing chords on a basis of thirds and also the major-minor key system, but he does not reject the principle of tonality. In this exposition of his conception of the nature of music, he utilizes the overtone series in arriving at a basic system for the tuning of the chromatic scale; he uses the resultant tones (Tartini tones) in a re-evaluation and ordering of intervals; he classifies all possible chord constructions in their degrees of relative strength and tension; and finally he outlines a system of analysis applicable to music both past and present. Whether his ideas will be widely enough assimilated to form a broader basis for the understanding of harmony remains to be seen. Of one thing we can be sure: there will continue to be further changes in our music, and new attempts to fathom the essential nature of harmony must follow in attempting to explain them. See MUSIC.

IRWIN FISCHER

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**HARMONY COMMUNITY.** See HARMONY SOCIETY; COMMUNISTIC SETTLEMENTS; OWEN, ROBERT.

**HARMONY OF THE GOSPELS.** See GOSPELS, HARMONY OF THE.

**HARMONY SOCIETY,** a small religious group distinguished by its pietistic spirit and communistic community organization. It was founded by GEORGE RAPP in Wurttemberg, Germany, with the aim of re-establishing the practices of early Christianity. After meeting hostility from the established Lutheran Church, Rapp and his converts came to the United States in 1803; they established the village of Harmony, Pennsylvania, in Butler County, organizing it as a communistic community with both sexes pledged to a life of celibacy. It appears that the communistic organization was adopted for reason of economic necessity rather than of religious principle. Harmony soon became a prosperous agricultural and industrial community, but in 1815 the Harmonists, or Rappites, moved to Posey County, Indiana, where they established a new village of Harmony on the banks of the Wabash with the same type of organization. In 1825 they sold their town to ROBERT OWEN in order to return to Pennsylvania, where they established a third village, called Economy, about 20 miles below Pittsburgh on the Ohio River. Dissention broke out in 1832 resulting in a split of the community. The Harmonists believed in the second coming of Christ and in the near advent of the millennium. Most of the property was sold in 1903, at which time only four members remained. See COMMUNISTIC SETTLEMENTS.

F. M.

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**HARMSWORTH, ALFRED CHARLES.** See NORTHCLIFFE, BARON.

**HARNACK, ADOLF VON,** 1851–1930, German Protestant theologian and church historian, was born in Dorpat, Estonia. Like his father, Theodosius Harnack, he was professor of theology at various German universities. During this time he taught KARL BARTH, whose views he later opposed. In 1904 he lectured in the United States and from 1905 to 1920 he was director of the Royal Library in Berlin. During the 35 years he was associated with the University of Berlin, he wrote extensively and had produced over 1,500 manuscripts at the time of his

death. His most important work, *History of Dogma* (Eng. trans. 1894–99), had a profound effect on Protestant thought. In it he expressed a critical attitude toward dogma and stated that the development of dogma was a harmful process brought about by the mingling of Greek thought with the gospel teachings. Like ALBRECHT RITSCHL, Harnack believed that Christianity was far more important as a pattern of living than as a system of dogma. He was one of the greatest authorities on church history and was well-known for his disbelief in speculative theology. Despite the opposition to his views, his influence was widespread, extending beyond Germany to the rest of Europe and America. Among his other works are *What Is Christianity?* (1901) and *Marcion* (1921).

M. R.

**HARNESS RACING** is conducted on half-mile and mile oval dirt tracks. The drivers, or jockeys, are seated on two-wheeled, pneumatic-tired sulkies hitched close to the horse. Harness and sulky are of very light weight, but the driver must supply a minimum weight of 150 pounds. The standard distance is one mile and records are based on this distance.

The gaits in harness racing are pacing and trotting. In pacing the horse's legs on each side move in unison. In trotting the fore and hind legs of the opposite sides travel in unison. Pacing may be a natural gait, but hobbles are usually worn to ensure that gait throughout a race. Should a horse, through nervousness or over anxiety, "break" into a gallop, a faster pace than trotting or pacing, the driver must check the horse until the required gait is resumed.

Harness races are generally run by "heats," the winner taking the best two out of three heats or three out of five. The day's races are so spaced by heats that the horses have time to cool off between heats.

The start is made by "scoring," the horses and drivers falling into their proper positions from the pole (inside rail position), some distance up the track from the "wire." The starter, by admonishing from the judge's stand through a megaphone, and the drivers, by careful maneuvering, try to get the horses away to an even start. Since this is generally difficult, particularly with large fields, many attempts at scoring may be made. At the word "Go" the field is away.

The various classes in harness racing are fixed by the horses' time for the mile. A horse may be entered for a stake if its record is not more than one-quarter second faster than the time specified for that particular race. In the popular "free for all" race any horse of the specified time may be entered.

A starting gate for harness racing has been designed to eliminate the tiring work of scoring, and races are sometimes run as individual heats. Classes are some-

"Hoot Mon," trotter which won 1947 Hambletonian

H. G. STRONG







A heat in the 1947 Hambletonian, harness racing classic

H. G. STRONG

times arranged according to the winnings of the horses. This change in the rules encourages the development of the horse's speed. Whether these changes will become universally accepted rests with the future.

**History.** Most famous trotters of the period from 1845 to the present time are: Lady Suffolk, who made a record of 2:29½ in 1845; Dester, 2:19 in 1867; Maud S., 2:08¾ in 1885; Nancy Hanks, 2:04 in 1892; Lou Dillon, 1:58½ in 1903; Peter Manning, 1:56¾ in 1922, and Greyhound, who set the world's record against time of one mile in 1:55¼ at Lexington, Ky., September 29, 1938.

There are two pacing families, the Naragansett pacers and the Hal family. Most pacers appear unexpectedly and sometimes without any apparent excuse, from animals bred in orthodox trotting lines. The generally accepted theory is that the pacing gait is due to "incongruity of conformation," produced by the uniting of dissimilar blood elements.

Gibson's Tom Hal Jr., founder of the Hal family, is credited with 16 pacers that have made records in standard time. Fastest was Hal Pointer (2:04½), so successfully raised and trained by E. F. (Pop) Geers. First get of Tom Hal Jr. to win national recognition was Little Brown Jug, which became world's champion light harness race winner August 24, 1881, at Hartford, Conn., winning three straight heats against Mattie Hunter and Lucy in 2:11¾, 2:11¾, and 2:12½. Other great pacers were Brown Hal, with a record of 2:12½; Dan Patch, 1:55¼, and Directum I, 1:56¾. The latter two remain kings of pacers.

Harness racing is peculiarly American, although fashionable at one time in Russia. While classed as professional it has an amateur spirit that is unknown to most sports. Owners are frequently drivers, and drivers are universally intelligent, sympathetic horsemen who grow old in their profession. The control of harness racing has been as clean and well directed as that of any sport, possibly cleaner because of the love of horsemanship. See HORSE RACING. V. L. S.

**HARNEY PEAK**, W South Dakota, in the BLACK HILLS, N of Custer. It is the highest point (altitude 7,242 ft.) east of the Rocky Mountains.

**HÄRNÖSAND**, or **Hernösand**, town and seaport, E central Sweden, seat of Västernorrland County, at the mouth of the Angerman River on the Gulf of Bothnia. Härnösand was settled in the 14th century and is said to be the first European city to install electric power (1885). The harbor is good, though it is ice-free only in summer. Its industries include an engine works, sawmills, tobacco factories, and a sulfite plant. Pop. (1949) 14,563.

**HAROLD I**, surnamed **Harefoot**, d. 1040, king of England, was the younger of Canute's two sons by his first wife, Alfgiva. On the death of CANUTE in 1035, the Witan bestowed upon Harold all the provinces north of the Thames; while the possession of Wessex in the south was given up to Canute's second wife, Emma, for her son, **HARDICANUTE**. In 1037 Wessex also submitted to Harold. See NORWAY, *History*.

**HAROLD II**, 1022?-66, English king, was the second son of Earl Godwin, with whom he was banished from England in 1051 and restored in 1052. When Godwin died in 1053, Harold, who had been Earl of East Anglia, succeeded him as Earl of Wessex, and as such ruled southern England. In 1055 and 1056

Harold put down the rebellions of Earl Aelfgar and Gruffydd ab Llewelyn of Wales. When Gruffydd invaded England again in 1062, Harold drove him out of England, and, with the aid of his brother Tostig, earl of Northumberland, fought the Welsh in their homeland. Harold was able to adapt his tactics to the Welsh locale. He ravaged Wales and executed every Welshman he captured, and planted his victory monuments at every battle site. Gruffydd agreed to pay tribute; the next year (1063) his former followers sent his head to Harold.

About 1064, for unknown reasons, Harold visited Normandy. After a brief imprisonment by Count Guy at Beaurain, he was delivered to William of Normandy at Eu. Ostensibly William's guest, he was compelled to take an oath to uphold William's claims in England.

Soon after Harold's return to England, he was accused by his brother Tostig of instigating a rebellion of Northumbrians. Harold denied the accusation but earned Tostig's hatred by granting all of the rebels' demands, including the banishment of Tostig. In 1066 the dying King Edward named Harold his successor, and the English nobles immediately elected and crowned him. Harold now awaited an invasion by William of Normandy. Meanwhile, **HAROLD HAARDRAADE**, king of Norway, had invaded England and joined forces with Tostig, defeating an English army at Gate Fulford. Harold's army defeated the invaders at Stamford Bridge, where both Haardraade and Tostig fell in battle. While victory was being celebrated, news came of William's invasion. Harold marched to Hastings, and was killed in battle by a Norman arrow. Accounts of Harold's life are based on old French and English chronicles, and on the **BAYEUX TAPESTRY**. See **WILLIAM I**; **HASTINGS, BATTLE OF**; **EDWARD THE CONFESSOR**. C. A.

**HAROLD I**, c. 850-933, king of Norway who was known as Harold Fairhaired because he had sworn never to have his hair cut until he had subdued the various petty rulers of Norway. After he had succeeded his father, Halfdan the Swarthy, as ruler of Vestfold in 863, he strove to become the master of Norway. His victories culminated with the great naval battle of Hafrstfjord (872), fought near present-day Stavanger. Most of the deposed nobles, refusing to submit to his system of feudalism, were forced to leave Norway. Many of them settled in Iceland and the islands off the coast of Scotland. Harold thus succeeded in uniting Norway into one kingdom and was succeeded by his son, Eric Bloodaxe.

**HAROLD III**, known as **Haardraade**, "Hard in Counsel," 1015?-66, king of Norway. After the de-

feat of his half brother Olaf in 1030, he took refuge in Novgorod, and for some years was head of the Varangian Guard at Constantinople. He joined a rebellion against his nephew Magnus in 1042, but in 1046 was given half of Norway as a peace settlement. He succeeded Magnus to the other half of the throne in 1047. Harold fought unsuccessfully with Denmark, and in 1066 fell fighting against England's HAROLD II at Stamford Bridge.

**HAROUN AL-RASCHID**, or **HARUN AL-RASHID**, 763 or 766-809, fifth of the Abbasside caliphs of Baghdad, was born at Ray (Rhagae), near Teheran, and ascended the throne when 22 years old. To the Western mind he figures chiefly as the hero of the *Arabian Nights* (see *ARABIAN NIGHTS ENTERTAINMENT*), and as the maintainer of a magnificent court, where he gathered around him a brilliant company of poets and scholars. His fame was carried to Europe by an embassy which Charlemagne sent to him. In reality, however, Haroun was not only ruthless and revengeful, but was also ungrateful; for out of sheer jealousy he murdered Jaafar the Barmecide and all his family, though it was to Jaafar's father that he virtually owed his throne (see *BARMECIDES*). He waged successful war against the Byzantine Empress *IRENE* and her successor *Nicephorus*. His empire extended from North Africa (Tunis) to Transoxiana.

**HARP**, a musical instrument of the string family. Roughly triangular in shape, the modern harp has 46 strings of catgut and, in the lower registers, of covered wire, attached to a frame. These strings are plucked for tone results. Believed to have originated from the bow of the hunter, the harp has a long history. A proof of its antiquity is the discovery by archaeologists of a painting on the wall of an Egyptian tomb representing an early version of the harp. The origin of the word "harp" is Teutonic, and this instrument was popular in the forests of Northern Europe during the early Middle Ages. Among the Celtic peoples, the harp has long held a position of prominence, and often figures in Celtic legends. The ancient Irish harps were handed down from father to son, and harpists were the poets and historians of the early Celtic culture. By the 9th century A.D., the harp had evolved into the present day form. In the 17th and 18th centuries, it was one of the most popular solo

musical instruments both in the British Isles and on the European Continent, but with the rise of complex symphonic music, it was found less often in instrumental ensembles. This was due to its harmonic limitations. The strings of the harp are tuned to a single key. As most instrumental music is written in changing keys, the inability of the harpist to shift from one key to another made its use awkward in the orchestra. This difficulty was in part overcome with the invention of the double-action harp in 1810 by Sebastian Erard. The double-action harp has a set of pedals at the base of its upright column which control the strings, tightening or

loosening them to produce the desired key. The harp in general use today has a range of  $6\frac{1}{2}$  octaves, and can play 8 major scales and 5 minor scales. In spite of technical improvements, the instrument has diminished in importance as a musical instrument, and is not often used in modern symphonic compositions, although it is often a part of the chamber orchestra.

HELEN STEWART

**HARP SHELL**, a genus of tropical gastropod molluscs. The shell is marked by prominent ribs arranged at regular intervals, and rich red and brown mottlings. Some 12 species are known, and fossil forms also occur in the Eocene of France.

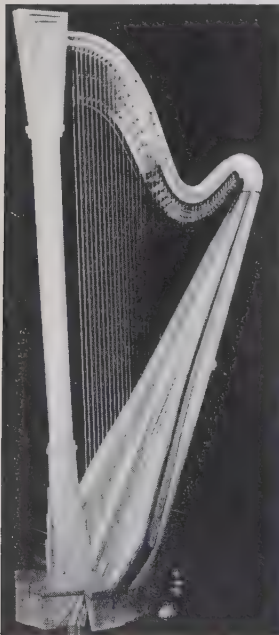
**HARPER, WILLIAM RAINEY**, 1856-1906, American educator and Hebrew scholar, was born in New Concord, Ohio, graduated from Muskingum College at the age of 14, and received his Ph.D. from Yale at 18. He taught Semitic languages and biblical exegesis at the Baptist Union Theological Seminary in Chicago (1879-81); was professor of Semitic languages at Yale (1881-86); and president of Chautauqua's College of Liberal Arts (1887-94). In 1891 he accepted the presidency of the new University of Chicago. It was Harper who was responsible for the university's becoming a great center of research and education instead of a traditional liberal arts college. He organized a faculty of brilliant scholars, a university press, university extension, etc., and under his direction the university grew financially and geographically. He meanwhile taught as chairman of the Semitics department, wrote several Hebrew textbooks, and edited various Hebrew journals which he had founded. Of his theoretical works, *Religion and the Higher Life* (1904) and *The Trend of Higher Education* (1905) are outstanding.

**HARPER**, port of entry, W Africa, in **LIBERIA**, on Cape Palmas.

**HARPERS FERRY**, town, E West Virginia, in Jefferson County, at the confluence of the Potomac and the Shenandoah rivers; on the Baltimore and Ohio Railroad and U.S. Highway 340; about 55 miles NW of Washington, D.C. The beauty of the town's setting—the combined rivers rush in a series of rapids through a gap in the Blue Ridge Mountains—is almost unparalleled in the United States. In 1747 Robert Harper established a ferry across the Potomac here. At the suggestion of George Washington, Congress ordered an arsenal built in Harpers Ferry in 1796 because of the abundant supply of water power. The arsenal was seized by the famous abolitionist **JOHN BROWN** and his followers on Oct. 16, 1859. Because of its position in the Shenandoah Valley and its railroad facilities, Harpers Ferry remained a disputed strategic base throughout the Civil War. Today the town is wholly a residential and resort community. It is the seat of Storer College. Pop. (1950) 822.

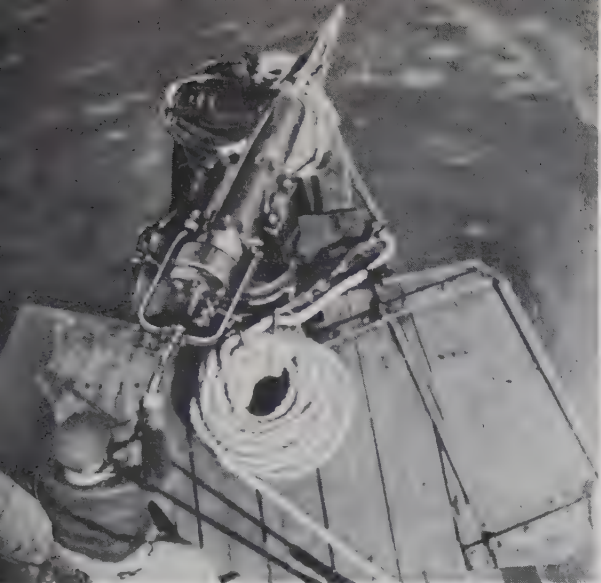
**HARPIGNIES, HENRI JOSEPH**, 1819-1916, French landscape painter, was born in Valenciennes. He visited Italy with Corot in 1860 and in the following year exhibited his first important work, "The Edge of the Woods on the Banks of the Allier," in which the influence of Corot is apparent. Among his other paintings are "The Wolf's Leap" (1873) and "Rising of the Moon" (1884).

**HARPOON**, a weapon used in capturing whales and large fish. In its oldest form it consisted of a flat triangular piece of iron with strong barbs sharpened on the outer edges, attached to a wooden handle, to which was fastened a long rope. The harpoon now most commonly used is the "toggle-iron"; it consists of a pointed shaft, in which is fastened, near the end, a pivoted crosspiece. When the rope is pulled, after the shaft has penetrated the fibrous tissue beneath the blubber of the whale, the crosspiece (which at first lies along the shaft) opens at right angles, and so prevents the shaft from being withdrawn. There are explosive harpoons which carry a bomb in their head and which explode after penetrating the whale,



A modern harp





SAN DIEGO NATURAL HISTORY MUSEUM

### Harpoon gun mounted on a swivel stand

usually killing it immediately. The ordinary harpoon is used only to secure the whale, the animal being usually killed with a lance.

**Harpoon Guns** are guns from which a whaling harpoon, with line attached, can be shot. Invented in 1865, the harpoon gun is, in principle, similar to ordinary light cannon. The gun can be aimed and fired with great accuracy. Light models are portable and may be shot from the shoulder, while larger, longer range types are mounted on a swivel stand in the bow of a whaling steamer. More recently the use of an electric current kills the whale. This is accomplished by shooting an electrically charged wire from the harpoon gun. See **WHALE**, Whaling.

**HARPUT.** See **KHARPUT**.

**HARPY**, a foul, predatory bird, in Greek mythology. They were originally personifications of the swift storm winds. In later writers they are described as hideous winged monsters, who harassed the blind Phineus by snatching his food from him, or by defiling it.

**HARPY**, or **HARPY EAGLE**, a bird of prey, of the family *Falconidae*, which inhabits Central and South America from southern Mexico to Paraguay and Bolivia. It is 38 inches in length, and of a general blackish-gray color, with six black bars on the tail, and a bifurcated gray crest on the white head; the under surface is white, with a gray band on the chest. The bird, which is the king eagle of the Spaniards, is the most powerful of the American birds of prey, and attacks mammals much larger and heavier than itself; fawns, peccaries, monkeys, and foxes are among its usual prey. It does not seem voluntarily to attack man.

**HARRIDGE, WILLIAM**, 1886–, American baseball official, born in Chicago, was first associated with the Wabash Railroad. He became secretary to Byron "Ban" Johnson, head of the American League. He succeeded E. S. Barnard as head of the league in 1931 and was its president from that time.

**HARRIER**, a kind of hawk. See **MARSH HAWK**.

**HARRIER**, a breed of small **FOXHOUNDS** averaging from 18 to 20 inches in height. The harrier is used in England for hare hunting and has been used in the United States for hunting since Colonial times. These hounds are not speedy but display great perseverance in picking up a cold scent.

**HARRIMAN, EDWARD HENRY**, 1848–1909, American railroad magnate and financier, was born in Hempstead, L.I. By the time he was 18 years old he had become a partner in a brokerage business, and soon after reaching his majority bought a seat on the New York Stock Exchange. In 1872 he

## Harris

founded the firm of Harriman and Company, bankers and brokers; in 1883 he became a director of the Illinois Central Railroad, and in 1887 its vice-president. He was a member of the syndicate which, after the **UNION PACIFIC RAILROAD** went into receivership (1893), bought the system for about \$62,000,000. He was made chairman of the executive committee of the new company in 1898, and by acquiring the Oregon Short Line, the Oregon Railway and Navigation Company, and the Central and Southern Pacific railroads, in a few years obtained a clear path from Chicago to the Pacific. His unsuccessful struggle with J. J. Hill and his associates to gain control of the Northern Pacific caused the Wall Street panic of May, 1901, and the Interstate Commerce Commission's investigation of 1906 again brought him prominently before the public. He died at his great estate, Tower Hill, in Arden, N.Y., on Sept. 9, 1909. At the time of his death he was master of 25,000 miles of railroad and had a controlling voice in the management of 50,000 more miles.

**HARRIMAN, WILLIAM AVERELL**, 1891–, American public official, born in New York, the son of E. H. HARRIMAN. Graduated from Yale, he was board chairman of the Union Pacific Railroad (1932–46) and a partner in Brown Brothers, Harriman (1931–46). He was ambassador to Russia (1943–46) and England (1946); secretary of commerce (1946–48); and special ECA agent in Europe (1948–50). He became Truman's special assistant for foreign affairs in 1950 and in 1951 was appointed Mutual Security Agency director. In 1952 he was an unsuccessful candidate for the Democratic presidential nomination.

**HARRIMAN**, city, E central Tennessee, in Roane County, at the foot of Walden's Ridge where it is pierced by the Emory River; on the Southern, the Louisville and Nashville, and the Tennessee Central railroads and U.S. Highway 27, 50 miles W of Knoxville in a farming region. Harriman, a rural trading center, was platted by the East Tennessee Land Company in 1889 and named for Gen. Walter Harriman; it was incorporated in 1891. Through the efforts of the land company's president, Gen. Clinton D. Fisk, candidate for the presidency in 1888 on the Prohibition ticket, all property within the city was prohibited from being used for the "making, storing, or selling of intoxicating liquor," a restriction which still stands. The city ships peaches, and hosiery, paperboard, oak flooring, tanning extracts, and farm implements are the chief manufactures. Pop. (1950) 6,389.

**HARRINGTON, JAMES**, 1611–77, English political philosopher, was born in Upton, Northamptonshire and was educated at Oxford. In his *Oceana* of 1656 he propounded a scheme for an oligarchical republic on the Venetian model, and in 1659 formed the Rota Club for the discussion of his theories.

**HARRIOT, THOMAS**, 1560–1621, English mathematician, physicist, and astronomer, was born in Oxford and studied at Oxford University. For several years he acted as tutor to **SIR WALTER RALEIGH** and enjoyed the patronage of Henry Percy, earl of Northumberland. When Raleigh organized an expedition to explore Virginia in 1585, Harriot was chosen to map the area and to bring back a detailed account of its plant, animal, and mineral resources. He fulfilled this mission by writing *A Briefe and True Report of the New Found Land of Virginia* (1588).

Harriot became known as the leading English astronomer of his day. He originated the solution of quadratic equations by factors, made several important changes in algebraic symbols and notations, and wrote one of the earliest mathematical textbooks, *Artis Analyticae Praxis* (1631). M. E. C.

**BIBLIOG.**—B. Jaffe, *Men of Science in America* (1944).

**HARRIS, SIR ARTHUR TRAVERS**, 1892–, British air chief marshal, was born in Cheltenham. He served in World War I in a Rhodesian regiment, transferring to the Royal Flying Corps in England

(1915), where he commanded squadrons and participated in reconnaissance flights over France. In 1919 he was given a permanent rank of squadron leader in the R.A.F. Following the war he commanded air squadrons in India, Iraq, and Kurdistan and was for two years staff officer in the Middle Eastern Command. Appointed to the air ministry in the department of the chief of the air staff, he became deputy director of plans (1933), air commodore (1937), vice-air marshal (1939), air marshal (1941). As R.A.F. bomber command chief (1942), he developed the "economic" and "saturation" raids which, with the U.S.A.A.F., were successful in destroying German war industries. In 1943 he was appointed air chief marshal. He wrote *Bomber Offensive* (1947).

**HARRIS, CHAPIN AARON**, 1806–60, American pioneer dental educator and author, was born in Pompey, N.Y. He studied medicine in the office of his brother John at Madison, Ohio, and practiced medicine at first. In 1828 he began to practice dentistry in Greenfield, Ohio, and after practicing in many different places he finally settled in Baltimore. Dr. Harris was instrumental in establishing the first dental journal in the world in 1839, *The American Journal of Dental Science*. With Dr. Horace Hayden, he secured the charter for the first dental school in 1840, the Baltimore College of Dental Surgery. He was a leader in organizing the first national dental society in 1840, The American Society of Dental Surgeons. His *Principles and Practice of Dental Surgery* (1839) was the first important work covering all branches of dental surgery and was the standard American textbook for many years. In 1849 he brought out the first dental dictionary.

FLORIS VAN MINDEN, D.D.S.

**HARRIS, CHARLES KASSELL**, 1865–1930, American music publisher and composer, was born in Poughkeepsie, N.Y. Writer of hundreds of popular songs, he is best known for his sentimental ballads, *After the Ball is Over* (1892) and *Break the News to Mother* (1897). He is the author of the autobiographical *After the Ball—Forty Years of Melody* (1926).

**HARRIS, FRANK**, c. 1855–1931, English author and editor, was born in Galway, Ireland. He went as a boy of sixteen to America and was variously engaged in teaching, clerical work, and the practice of law. He later settled in London, where he became editor successively of *The Evening News*, *The Pictorial World*, *The Fortnightly Review*, and *The Saturday Review*. In 1907 he visited the United States and in 1908 published *The Bomb*, a remarkable story of the Haymarket Square Riots in Chicago (1886). He was distinguished for his vigorous and original short stories, notably *Elder Conklin* (1894), *Montes the Matador* (1900), and *Unpathed Waters* (1913). Among his other works were: *The Man Shakespeare* (1909); *The Women of Shakespeare* (1911); the novel, *Great Days* (1914); *Contemporary Portraits* (1915–27); *Oscar Wilde* (1916); *My Life and Loves* (1923–27); *My Reminiscences as a Cowboy* (1930).

**HARRIS, GEORGE WASHINGTON**, 1814–69, American humorist, was born in Allegheny City, Pa. An ingenious, mechanical-minded youth, he became a steamboat captain at 21 and later established a combination jewelry store and workshop in Knoxville, Tenn. After the Civil War, he worked as an engineer, and later as superintendent, on the Wills Valley Railroad. He is best known, however, for his *Sut Lovingood's Yarns* (1867), a collection of tales built around a rude, gangling, prank-playing native of the Great Smokies. Many of the stories were originally contributed to the New York sporting magazine, *The Spirit of the Times*, under the pen names of "Sugartail" and "Sut Lovingood."

BIBLIOG.—F. J. Meine, *Tall Tales of the Southwest* (1930).

**HARRIS, ISHAM GREEN**, 1818–97, American legislator, was born near Tullahoma, Tenn. He began to practice law in Paris, Tenn., in 1841; served in

the state legislature in 1847; and was a Democratic representative in Congress from 1849 to 1853. In 1857 he was elected governor of Tennessee, and was re-elected in 1859 and 1861. When the southern states had begun to secede he advocated the adoption of constitutional amendments to the Federal Constitution sanctioning slavery as the only remedy for the situation. By the authority of the legislature he entered Tennessee in the military league of the Confederate states. When Nashville was occupied (1862) by Federal troops, he fled from Tennessee and was afterward volunteer aide to Gen. A. S. Johnston (who fell at Shiloh) and other commanders. After the war he fled to Mexico, then to England, with a price on his head. He returned to his law practice in Memphis in 1867, was elected U.S. senator to fill a vacancy in 1877, and was re-elected three times.

**HARRIS, JOEL CHANDLER**, 1848–1908, American author and journalist, was born in Eatonton, Ga. He began his career as a printer's devil but graduated to journalism, writing first for the *Monroe Advertiser* and the *Savannah Morning News*. In 1876, he moved to Atlanta where he spent 24 years on the editorial staff of the *Constitution*. In 1879 he began contributing to the *Constitution* sketches in which Uncle Remus, an aged Negro servant, relates old plantation tales and fables and other traditional Negro lore. Original, humorous, and written in authentic dialect, the Remus stories were an immediate success and

made the name Harris synonymous with Southern folklore. A first collection *Uncle Remus: His Songs and Sayings* (1880), was followed by *Uncle Remus and His Friends* (1892), *The Tar Baby and Other Rhymes of Uncle Remus* (1904), *Uncle Remus and Brer Rabbit* (1906), and others. Harris also wrote such tales of Georgia life as *Mingo* (1884), *Free Joe* (1887), *Balaam and His Master* (1891), *Chronicles of Aunt Minervy Ann* (1899), and *Making of a Statesman* (1902).



CHICAGO HIST. SOC.

Joel C. Harris

BIBLIOG.—R. L. Wiggins, *The Life of Joel Chandler Harris* (1918); J. C. Harris, *The Life and Letters of Joel Chandler Harris* (1918), *Joel Chandler Harris: Editor and Essayist* (1931); A. F. Harlow, *Joel Chandler Harris* (1941).

**HARRIS, ROBERT**, 1849–1919, Canadian artist, was born in North Wales. As a boy he went with his parents to Prince Edward Island and was educated in Prince of Wales College, Charlottetown. He studied art in London, Paris, Italy, Belgium, and Holland and in 1880 became a member of the Royal Canadian Academy, of which he was later president (1893–1906). He is known chiefly as a figure and portrait painter. His works include "The School Trustees" and portraits of the Earl of Aberdeen, Lord Strathcona, Lord Minto, Sir Hugh Allen, Bishop Williams, and Sir G. A. Drummond. His "The Fathers of Confederation" was lost in the fire of 1916 in the Parliament Buildings at Ottawa. See CANADIAN ART for picture.

**HARRIS, ROY**, 1898–, American composer, was born in Lincoln County, Okla. He served in World War I, attended the University of California (1919–20), and studied music under Arthur Farwell and Nadia Boulanger. In 1926 his *Andante* for orchestra was chosen for performance by the New York Philharmonic-Symphony Orchestra, and in 1927–28, while studying abroad, he won Guggenheim fellowships. His more important works—characterized by their use of a nationalistic idiom—include a Quintet for piano and strings, the Quintet for two violins, two violas, and a cello, the *Symphony 1933*, *A Song for Occupations*, *When Johnny Comes Marching Home*, *American Overture*, *Third Symphony*, and *Fifth Symphony*.

**HARRIS, SAM HENRY**, 1872–1941, American theatrical producer, was born in New York City.



## Harris

He began his theatrical career by organizing holiday entertainments, promoting prize fights and horse racing, and working as a theatrical manager. In the last capacity, he was associated with the successful burlesque, *The Gay Morning Glories*; from this he went into partnership with the firm of Sullivan, Harris, and Woods. He worked from 1904 to 1920 with GEORGE M. COHAN, the alliance producing such hits as *Little Johnny Jones* and *Get Rich Quick Wallingford*. After 1920 he presented a number of independent productions, among them the hit plays *Rain*, *The Jazz Singer*, *Dinner at Eight*, *Of Mice and Men*, *I'd Rather Be Right*, *Of Thee I Sing*, *Stage Door*, and *You Can't Take It With You*.

**HARRIS, THOMAS LAKE**, 1823–1906, American spiritualist and founder of the Brotherhood of the New Life (1861). Born in Penny Stratford, England, he came to America when a child and in 1845 became preacher of the Fourth Universalist Society, New York City. In 1848 he organized in New York an independent church which grew out of his interest in spiritualism. He wrote a number of poems which he claimed were received by him while in trance. His own teachings were greatly influenced by those of SWEDENBORG and FOURIER, recognizing scriptural authority and the sanctity of marriage. Settlements of the Brotherhood of the New Life were established at Amenia and Brocton, N.Y., and later at Santa Rosa, Calif. His works include *The Arcana of Christianity* (1858); *The Millennial Age* (1861); *The Song of Theos* (1903).

BIBLIOG.—G. M. Hort, R. B. Ince, and W. P. Swainson, *Three Famous Occultists* (1940).

**HARRIS, TOWNSEND**, 1804–78, American diplomat, was born at Sandy Hill, N.Y. He was the first American consul general to Japan (1855), and in 1857 drew up a treaty between the United States and Japan, the first agreement of the kind to be entered into by Japan, and the model for subsequent treaties with other foreign powers. Before going to Japan, Harris was president of the New York Board of Education and also one of the founders of the New York Free Academy, now the College of the City of New York.

**HARRISBURG**, city, SE Illinois, county seat of Saline County; on the New York Central Railroad and U.S. Highway 45, about 70 miles NE of Cairo. Harrisburg is located in an extensive coal producing region which was first mined in 1885. Saline ranks near the top among Illinois counties in the production of coal. An agricultural market center, Harrisburg also has packing plants and railroad yards. Pop. (1950) 10,999.

**HARRISBURG**, city, Pennsylvania, capital of the state and county seat of Dauphin County, on the E bank of the Susquehanna River; served by the Pennsylvania and the Reading railroads; at the junction of U.S. highways 11, 15, 22, 111, 230, 322, and 422. It is picturesquely situated a few miles below a gap in one of the ridges of the Alleghenies. A coal and iron-producing district and a fertile farming and dairying region surround Harrisburg. Industrial development came naturally after the city became a canal and railroad center.

Outstanding among the capital's buildings are the capitol group, a U-shaped unit of six limestone and granite structures set on a 13-acre landscaped



Pennsylvania state capitol at Harrisburg, completed in 1906

PENNSYLVANIA STATE DEPT. OF COMMERCE

eminence and developed between 1906 and 1939. The magnificent capitol, which replaced the original building destroyed by fire in 1897, is noted for its works of art. Among the landmarks of Harrisburg is Harris Mansion, built by the city's founder in 1766. More than 1,400 acres of parks include River Park with its unique four-mile promenade along the river; Island Park in the Susquehanna; Harris Park, containing the grave of the founder; Wildwood; Italian Lake Park; and the Municipal Rose Garden. Among the city's educational and cultural facilities are modern public schools, several private schools, a symphony orchestra, several libraries, including the State Library, and the Pennsylvania State Museum, specializing in historical and artistic work by native sons or about Pennsylvania.

The city has an extensive wholesale and retail trade, railroad shops, steel plants, meat packing plants, and factories producing cotton wearing apparel, hosiery, shoes, cigars, chemicals, silk, and precision machinery. The city has the commission type of government, adopted in 1913.

Settled by John Harris in 1733 at a point where the Susquehanna could be easily ferried, the city first was known as Harris's Ferry. In 1785, John Harris, Jr., laid out the town and named it Harrisburg, setting aside four acres as a possible location for the future capitol of the state. In 1812, Harrisburg became the state capital and this new prestige aided its growth. During the Civil War, Camp Curtin, the first camp for Union troops, was established here. The city escaped occupation by the Confederates in 1863 when General Lee turned his army aside after advance units came within sight of the city. Pop. (1950) 89,544.

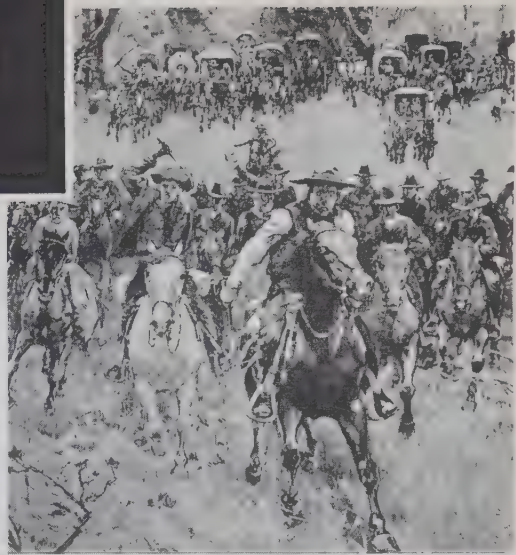
**HARRISON, BENJAMIN**, c. 1726–1791, American patriot, one of the signers of the Declaration of Independence, was born in Berkeley, Va. He studied at William and Mary College and was early elected to the House of Burgesses. From 1774 to 1777 he was a delegate to the first Continental Congress. As chairman of the committee of the whole house he presided over the debates upon the Declaration of Independence and reported the document as having been approved July 4, 1776. He was subsequently speaker of the House of Burgesses of Virginia (1777–82) and governor of the state (1782–84), and a member of the convention that ratified the Federal Constitution (1788). WILLIAM H. HARRISON, his son, and BENJAMIN HARRISON, his great grandson, became presidents.

It happened when  
**Benjamin Harrison**  
 was president . . .



PHILADELPHIA INQUIRER

**Johnstown Flood**, which swept through Conemaugh Valley in 1889, took the lives of over 2,000 people



THE BETTMANN ARCHIVE

**Opening of Oklahoma Territory** on Apr. 22, 1889, caused a mad rush of settlers to the new land



**Sitting Bull**, attempting to escape arrest during messiah craze of 1890, was killed by Indian police



ACME

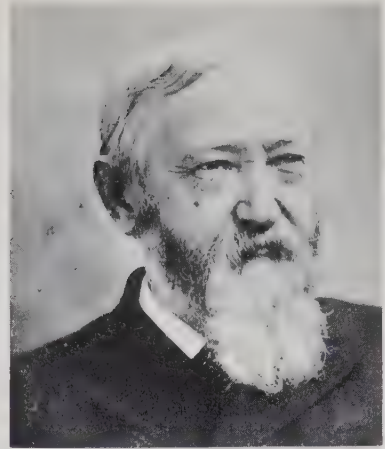
**Roll Film** was invented in 1889. This is Edison's "Black Maria," world's first motion picture studio

**White Squadron**, first steel battleships of U.S., gave farewell salute to John Ericsson, 1890

U.S. NAVAL ACADEMY







MESERVE COLLECTION, N.Y.

## BENJAMIN HARRISON

23rd President of the United States

1889-1893

**HARRISON, BENJAMIN**, 1833-1901, 23rd president of the United States, was born in North Bend, Ohio, on Aug. 20, 1833. He was the grandson of **WILLIAM HENRY HARRISON** and the great-grandson of **BENJAMIN HARRISON**, one of the signers of the Declaration of Independence. He was graduated from Miami University, Oxford, Ohio, in 1852; studied law at Cincinnati, Ohio; was admitted to the bar in 1854, practiced law with great success in Indianapolis, Ind., and in 1860 was elected reporter of the Supreme Court of Indiana. During the Civil War he served with distinction in the Federal Army. He assisted in raising a regiment of infantry—the 70th Indiana Infantry—in the summer of 1862, soon became its colonel (commissioned August, 1862), rendered conspicuous services under General Sherman during that officer's Atlanta campaign in 1864, commanding a brigade at Kenesaw Mountain and Peach Tree Creek, and later commanded a reserve brigade in the Battle of Nashville. In January, 1865, he was brevetted brigadier general of volunteers "for ability and manifest energy and gallantry in command of a brigade," and in June, 1865, he was mustered out of the service. Returning to Indianapolis, he was again, until 1868, reporter of the Supreme Court, having been re-elected to this position in 1864 while in the field.

In 1876 Harrison was Republican candidate for the governorship of Indiana, but was defeated. As chairman of the Indiana delegation he took a prominent part in the Republican National Nominating Convention of 1880, where he advocated the nomination of James A. Garfield; and from 1881 to 1887 he was a prominent member of the United States Senate, being chairman of the Committee on Territories and a member of several other committees, and attracting attention as an effective speaker and as a sharp critic of President Cleveland's administration. His speeches in support of a protective tariff and of civil service reform were especially able. In 1888, as the Republican candidate, he defeated Cleveland for the presidency, and in 1892 was in turn defeated by Cleveland.

**Harrison's Administration** (1889-93) was marked by the amicable settlement, by arbitration, of the Bering Sea dispute with Great Britain, by the holding of the Pan-American Congress of 1889-90 in Washington, by the passage of the McKinley Tariff Bill and the Sherman Silver Bill of 1890, by the admission into the Union of the states of Montana, Washington, North and South Dakota, Wyoming, and Idaho, by a diplomatic difficulty with Chile growing out of the attack of a mob in Valparaiso on sailors of the U.S. cruiser *Baltimore*, and one with Italy growing out of the killing of Italians by a mob in New Orleans, and by the suppression of the Louisiana lottery. See

**BERING SEA CONTROVERSY; SHERMAN SILVER PURCHASE ACT; PAN-AMERICAN MOVEMENT.**

After the close of his term Harrison resumed his law practice, and in 1899 was the chief counsel of Venezuela before the arbitration tribunal at Paris, assembled to settle the boundary dispute between that government and Great Britain. See **VENEZUELA, History.**

Personally he was reserved—by his political enemies he was called cold, proud, and austere—and was never especially popular with the mass of the people; but he was a lawyer and a statesman of unusual ability, a clear thinker, an incisive and vigorous speaker and writer. He died at Indianapolis, March 13, 1901, and is buried in North Bend, Ohio. He wrote *This Country of Ours* (1897) and *Views of an Ex-President* (1901). His *Correspondence 1882-1893* (1940) was edited by A. T. Volwiler.

President Harrison's boyhood home near Cleves, Ohio, is still standing. His home in Indianapolis, Ind., built in 1872, is now a memorial unit of the Arthur Jordan Conservatory of Music.

**HARRISON, CARTER HENRY**, 1825-93, American political leader, was born in Fayette County, Ky., and was educated at Yale and at the Transylvania Law School, in Covington, Ky. He represented Illinois in the 44th and 45th Congresses as a Democrat, and was elected mayor of Chicago in 1879, and for the three following biennial terms. As Democratic candidate for governor of Illinois he was defeated in 1884. He was again elected mayor of Chicago in 1893, despite the opposition of the independent and Republican elements, after a campaign during which his supporters were accused of grossly corrupting the electorate. He was assassinated in 1893.

**HARRISON, JOHN**, 1693-1776, English inventor, was born in Foulby, Yorkshire. His experiments in the construction and repair of watches resulted in the "gridiron pendulum" (1726) and a **CHRONOMETER** (1749) awarded the Royal Society's gold medal. In 1763 he claimed the prize offered by Parliament almost 50 years earlier for the discovery of a method for determining longitude to within a maximum error of 30 miles. In 1773 after George III had intervened he received the award of £20,000 from the Board of Longitude.

**HARRISON, LOVELL BIRGE**, 1854-1929, American landscape painter, born in Philadelphia. He studied at the Pennsylvania Academy of the Fine Arts and the École des Beaux-Arts and during the 1880's traveled extensively. His best work was done with nocturnal subjects, as in "Calling Home the Cows," "Moonlight off Charleston," "Moonrise on the Beach," and "Fifth Avenue at Twilight." He founded the Woodstock Art Colony and published *Landscape Painting* (1909).



During the life of  
**William H. Harrison**



**THE HARD CIDER QUICK STEP**

Composed & Respectfully Dedicated to the  
DELEGATES OF THE

GREAT WHIG CONVENTION

BETTMANN ARCHIVE

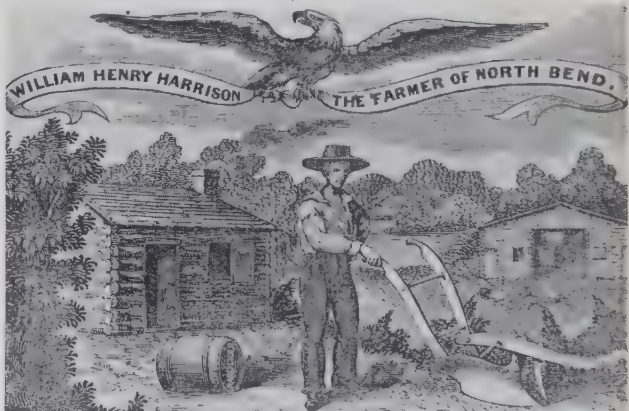
Party Songs and Emblems, above, were first used in a presidential contest in Harrison's "Log Cabin and Hard Cider" campaign of 1840. Other innovations, below, were party banners and processions

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CHICAGO HISTORICAL SOCIETY

Harrison's Victory in the Battle of the Thames in 1813 broke British power in Northwest Territory



CHICAGO HISTORICAL SOCIETY

Harrison Poster in the exuberant campaign of 1840 featured everpresent log cabin and keg of hard cider



CHICAGO HISTORICAL SOCIETY

Harrison Defeated the Indians led by Tecumseh's brother in the famous Battle of Tippecanoe in 1811

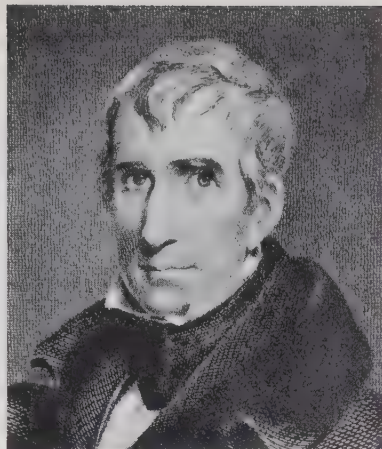




## WILLIAM HENRY HARRISON

### 9th President of the United States

### 1841



SMITHSONIAN INST.

**HARRISON, WILLIAM HENRY**, 1773–1841, ninth president of the United States, was born in Berkeley, Charles City Co., Virginia, Feb. 9, 1773. He was the son of **BENJAMIN HARRISON** (c. 1740–91), a signer of the Declaration of Independence. He entered the United States army in 1791, served under General Wayne against the western Indians, and then, ranking as captain, resigned from the service in 1798, when he became secretary of the **NORTHWEST TERRITORY**, whose delegate in Congress he was in 1799–1800. From 1801 to 1813 he was governor of Indiana Territory (comprising at first what are now the states of Indiana, Illinois, Wisconsin, and Michigan), and also United States Indian commissioner. He defeated the Indians in the famous **Battle of Tippecanoe** (Nov. 7, 1811), and during the **WAR OF 1812**, first as brigadier general and then as major general, was in command of the United States troops in the Northwest, distinguishing himself particularly at the **Battle of the Thames** (Oct. 5, 1813), in which the defeated General Proctor and his Indian allies. Resigning in 1814, he moved to North Bend, in Ohio, which state he represented in the lower house of Congress (1816–19), and in the Senate (1825–28). He was then United States minister to Colombia (1828–29). In 1835 he was nominated for the presidency of the United States by the bulk of the Whigs and was also the candidate of the Anti-Masonic party. In the election of 1836 Van Buren triumphed. In 1840 Harrison was nominated for the presidency, Van Buren being again his opponent. After a campaign famous in American history for its exuberant spirits and its introduction of various innovations—vast processions and camp meetings, the flaunting of party banners, the wearing of party emblems, the singing of party songs—Harrison was elected in 1840, with **JOHN TYLER** as vice-president, but died in Washington only a month after his inauguration. His *Messages and Letters* (1922) was edited by Logan Esarey.

President Harrison's birthplace in Berkeley, Va., begun in 1726, and his home in Vincennes, Ind., used as a military headquarters and fortress against Indian attacks, are both museums. William Henry Harrison Memorial State Park at North Bend, Ohio, contains the Harrison Monument. See **TECUMSEH**.

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**HARRISON**, town, New Jersey, Hudson County, on the Passaic River, opposite Newark with which it is connected by bridges; on the Pennsylvania, the Lackawanna, the Erie, and the Hudson and Manhattan railroads. Once called East Newark, Harrison is an outgrowth of the industrial metropolis, specializing in gigantic machine shops. The city was settled in 1668 and incorporated in 1873. Pop. (1950) 13,490.

**HARRISON**, township, W Pennsylvania, in Allegheny County, served by the Baltimore and Ohio Railroad, in the Pittsburgh industrial area. Pop. (1950) 15,116.

**HARRISON, FORT**, a military post on the site of present-day Terre Haute, Ind., constructed in 1810–11 for protection against Indian attacks led by **TECUMSEH**, and named for William Henry Harrison. In 1812 its garrison under the command of Capt. Zachary Taylor withstood an Indian attack. The fort was abandoned in 1817, by which time the settlement of Terre Haute had grown up around it.

**HARRISON LAND ACT**, a land law of 1800 named for William Henry Harrison, delegate to Congress from the Northwest Territory. It was an amendment to the act of 1796, which had encouraged the purchase of land for speculation. The 1800 act was enacted to stimulate sales to prospective settlers. West of the Muskingum River land might be sold in tracts as small as 320 acres, but east of this stream no sales were to be made in units under 640 acres. The credit system was lightened under terms which permitted payment within four years. The minimum price of two dollars an acre was retained, as was also the auction system of selling. Four land districts were set up with offices at Cincinnati, Chillicothe, Marietta, and Steubenville. The law stipulated the dates for the annual auctions at the four offices, but it permitted private sales at other times. This act was the beginning of a democratic policy in the disposal of the **PUBLIC LANDS OF THE UNITED STATES**, which culminated in the **HOMESTEAD LAWS**. See also **LAND GRANTS**.

**HARRISONBURG**, independent city, NW Virginia, county seat of Rockingham County, on the Chesapeake Western and the Southern railroads and U.S. highways 11 and 33, about 116 miles NE of Roanoke. Harrisonburg is situated in the beautiful Shenandoah Valley at an altitude of 1,338 feet. It was founded in 1739 by Thomas Harrison. Madison College and the Eastern Mennonite School are located here. The chief products are shoes, rayon, flour, furniture, bricks, fertilizer, and plows. Pop. (1950) 10,810.

**HARRISSE, HENRI**, 1830–1910, French historian, was born in Paris. He lived in the United States from 1847 until 1866, teaching French literature at Georgetown University and practicing law in New York and Chicago. He became a naturalized American citizen but later settled permanently in France, where he devoted himself to the study of early books and manuscripts relating to the discovery of America. His principal works include *Bibliotheca Americana Vetusissima* (1866), a valuable list of Americana in the period 1493–1551; *Notes on Columbus* (with Samuel Barlow, 1866); *D. Fernando Colón, historiador de su padre*



**Harrow, famous English school for boys**

ACME

(1871); *Notes pour servir à l'histoire, à la bibliographie et à la cartographie de la Nouvelle-France* (1872); *Christophe Colomb* (1884-85); *Découverte de l'Amérique du Nord* (1892); *John Cabot, the Discoverer of North America* (1896).

**HARRODSBURG**, city, N central Kentucky, county seat of Mercer County, on the Southern Railroad and U.S. Highway 68; about 30 miles SW of Lexington. Harrodsburg is a popular health resort with sulfur springs. It is a trade center of a farm region which specializes in trotting horses, poultry, and white burley tobacco. Harrodsburg is situated in the Bluegrass country on a hill just west of the upper Kentucky River. Laid out in 1774 by Capt. James Harrod, Harrodsburg was the first white settlement in Kentucky. Before the Civil War, it was a summer resort for the plantation owners of the deep South. The Pioneer Memorial State Park stands on the site of old Fort Harrod. A replica of the fort, the cabin in which Lincoln's parents were married, and a statue of George Rogers Clark are historic features of the park. Pop. (1950) 5,262.

**HARROGATE**, municipal borough and watering place, England, Yorkshire, in the West Riding; 15 miles N of Leeds; 19 miles W of York. It is the largest spa of Great Britain, a popular holiday resort owing its fame to the discovery of more than 88 sulfur and chalybeate springs (the first discovered in 1571). The town consists of High and Low Harrogate, the former built on a moor at an altitude of 400 feet, the latter in a valley. Low Harrogate has 32 bog wells, all differing in the character of the waters. Pop. (1950 est.) 51,870.

**HARROW**, or **Harrow-on-the-Hill**, town and urban district, SE England, in Middlesex; 10 miles NW of London. The famous English school for boys, founded in 1571 by John Lyon, is located here. Many famous Englishmen have been educated here. During World War II, in 1940, the buildings were bombed but suffered little damage. On the summit of the "Hill" (alt. 375 ft.) is the Norman church of St. Mary, founded in 1094 by Lanfranc, archbishop of Canterbury. In addition to the school, Harrow has important printing and photographic works. Harrow is an atomic research center. Pop. (1950 est.) 223,370.

**HARRY, BLIND**. See **HENRY THE MINSTREL**.

**HARSPRANG FALLS**. See **WATERFALLS**.

**HART, ALBERT BUSHNELL**, 1854-1943, American historian, was born in Clarksville, Pa., and educated at Harvard, Freiburg (Germany), and Geneva. He was on the faculty at Harvard from 1887, advancing from history instructor to professor of government, until 1926, when he became professor emeritus. He was a member of the Massachusetts Constitutional Convention and chairman of the committee on amendment and codification (1917-19); joint editor of the *American Historical Review* (1895-

## Harte

1909); president of the American Historical Association (1909) and of the American Political Science Association (1912). He was the author, joint author, or editor of nearly 100 volumes. His numerous historical works include *Guide to the Study of American History* (1897, with Edward Channing) and *Formation of the Union* (1892; ed. 1925). He edited *The American Nation* (28 vols. 1903-18); *Epochs of American History* (4 vols. 1891-1926); *Source Readers in American History* (5 vols. 1901-27); *American History Told By Contemporaries* (5 vols. 1898-1929).

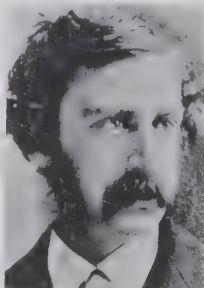
**HART, GEORGE OVERBURY**, 1868-1933, American painter and etcher known as "Pop," was born in Cairo, Ill. Largely self-taught, though he did study briefly at the Chicago Art Institute and the Julien Academy, Paris, he spent much of his time wandering over the globe and sketching the common people seen in his travels. In later life he devoted himself almost exclusively to etching, his strong sense of draftsmanship winning him a high place among the practitioners of that art. His better work includes the landscape painting, "Santo Domingo," and the lithograph, "Springtime, New Orleans."

**HART, HASTINGS HORNELL**, 1851-1932, American social worker, was born in Brookfield, Ohio. Trained for the ministry, he left a pastorate to become secretary of the Minnesota State Board of Charities and Corrections in 1883. He was superintendent of the Illinois Children's Home and Aid Society (1898-1909) and helped to draft the first juvenile court law in the United States. He joined the Russell Sage Foundation of New York in 1909 as director of the child help department; in 1924 he became its consultant in delinquency and penology.

**HART, MOSS**, 1904- , American playwright and librettist, was born in New York City and was educated in the public schools there. Many of his most successful works were written in collaboration with George S. Kaufman. These include satirical plays and comedies of character and manners: *Once in a Lifetime* (1930), *Merrily We Roll Along* (1934), *You Can't Take It With You* (1936; Pulitzer prize award), and *The Man Who Came to Dinner* (1939); and a musical comedy, *I'd Rather Be Right* (1937). Hart also collaborated on *Face the Music* (1932) and *As Thousands Cheer* (1933), with Irving Berlin, and *Jubilee* (1939) and *Lady in the Dark* (1941), with Cole Porter. He wrote the film *Gentleman's Agreement* (1947) and the stage comedy *Light Up the Sky* (1948); and directed *Miss Liberty* (1949).

**HARTE, FRANCIS BRETT**, known as **Bret Harte**, 1839-1902, American short story writer, poet and novelist, was born in Albany, N.Y., the son of a school teacher. He had little formal education but read widely in his father's library, his favorite author

being Dickens, whose influence may be seen in Harte's personality as well as his writings. In 1854 he moved to California, where he worked at a number of odd jobs: as apothecary's helper, tutor, school teacher, express messenger, miner, and printer's devil. In 1860 he settled in San Francisco, working as a compositor on the *Golden Era*, a newspaper to which he had already contributed a quantity of fugitive verse and prose. From 1863 to 1867 he was secretary of the Branch



CHICAGO HIST. SOC.

**Bret Harte**

Mint and served for a time as editor of *The Californian*. His contributions to the *Golden Era* and *The Californian*, collected in book form as *The Lost Galleon* (1867) and *Condensed Novels* (1867), won him a local reputation, but he first received wide recognition in 1868 when he was appointed editor of a new Californian magazine, *The Overland Monthly*. His short stories, "The Luck of Roaring Camp" and "The Outcasts of



Poker Flat," published in early issues, were romantic, Dickensian portraits of the rough, colorful life of the last frontier. His formula of humor, pathos, and whimsey, combined with a shrewd use of local color, proved irresistible to the reading public of Victorian America, and when he left California for the East in 1870 he was already one of the leading literary figures of the age. At the same time, he achieved fame as a humorist with "Plain Language from Truthful James." This comic ballad, better known as "The Heathen Chinee," introduced to the general public the Pike County character, a rugged Midwestern type who became a stock figure in American literature.

Harte's best short stories were collected as *The Luck of Roaring Camp and Other Sketches* (1870) and *Tales of the Argonauts* (1875). In his later stories, in his novel *Gabriel Conroy* (1876), and his two plays, *Two Men of Sandy Bar* (1876) and *Ah Sin* (1877, with Mark Twain), he resorted to perfunctory exploitation of the material from which he had drawn his early works. His vogue rapidly declined and he was harassed by an accumulation of debt resulting from his own carelessness in money matters and his wife's extravagance. In 1878 he left his wife and four children and went to Europe, where he spent the rest of his life. He served as United States consul at Crefeld, Prussia (1878-80) and in Glasgow (1880-85), and then settled permanently in London, where he continued his writing, working away at the old vein of the California frontier. His later fiction was well received in England but he never regained his prestige in America.

J. J. M. BIBLIO.—G. R. Stewart, Jr., *Bret Harte: Argonaut and Exile* (1931); A. F. Harlow, *Bret Harte of the Old West* (1943).

**HARTEBEEST**, an African ANTELOPE of which there are a great many varieties. The typical hartebeest varies in color from pale fawn to reddish-brown, and stands from three to four feet high. Its ringed horns diverge from the head in the form of a V, with the tips bent backward at right angles. These swift animals gather in herds and are hunted for food. Of the true hartebeests the bubal, *Bubalis buselaphus* is a northern form, the kaama, *B. caama*, a southern form. The blesbok and BONTÉBOK are also classed as hartebeests, but of a different type.

**HARTEBEESTPOORT DAM.** See DAM.

**HARTFORD**, city, central Connecticut, capital of the state and seat of Hartford County, at the head of navigation on the Connecticut River; on the New York, New Haven, and Hartford Railroad; U.S. highways 5, 6, and 44; and the American and the United air lines; situated approximately midway between New York City and Boston. Hartford, a port of entry in the sixth U.S. customs district and the largest city of the state, occupies a commanding site of 18 square miles. Pop. (1950) 177,397.

**Buildings.** Among its many outstanding buildings is the capitol, which overlooks the city from the landscaped crest of Capitol Hill set in Bushnell Park, the heart of Hartford. Near by stands the First Church of Christ, known as Center Church, which was organized in Hartford in 1636 by THOMAS HOOKER and Samuel Stone. Adjoining the church is an old cemetery in which lie buried many of the founders of the colony and church. Across the street is a group of museum buildings, a city block long, which comprises the Wadsworth Atheneum. The group includes the Avery Art Memorial, with its collections of outstanding portraits of American and European masters, early American furniture, and Russian ballet designs. The Colt Memorial houses a collection of firearms made by the Hartford armorer, Col. Samuel Colt. The Morgan Memorial, in the group, was built in 1908 by J. Pierpont Morgan in memory of his father, who lived in Hartford. The memorial has a priceless collection of tapestries, porcelain, and other art treasures. Among the office buildings, the most prominent is the 527-foot Travelers' Insurance



U.S.D.A.F.S.A.

State capitol building at Hartford, Conn.

Company building, with its beaconed tower, New England's highest structure.

Hartford is the seat of many schools of higher education. The oldest of these, founded in 1823, is the famous Trinity College for men. The Hartford Seminary Foundation houses the Hartford School of Religious Education and the Kennedy School of Missions. Other schools in the city are St. Joseph's College for women, St. Thomas Seminary, the Hartford College of Law, the Hartford College of Insurance, and the Hartford School of Music. There are two daily newspapers in the city, the *Courant* being the oldest in the United States.

**Industries and Government.** Hartford is known chiefly as an insurance center because of the concentration of insurance companies here. It has a daily premium flow of more than \$2,000,000 and 44 home insurance offices with more than 14,000 employees. In addition, Hartford is an important tobacco and agricultural market. Manufactures include typewriters, machine tools and gages, aircraft engines and propellers, firearms, brushes, coffee and tea makers, valves, plastics, electrical devices, steam turbines, and chains. The city charter of 1856 was revised in 1914, vesting the government in a mayor elected biennially, a board of 20 aldermen, and commissions appointed by the mayor. In 1929 the city approved the metropolitan district plan uniting the towns of Hartford, East Hartford, West Hartford, Bloomfield, Windsor, Newington and Wethersfield under a metropolitan charter. This region covers 100 square miles and 250,000 population.

**History.** In 1623 the Dutch set up a trading post at the junction of the Park and Connecticut rivers (Dutch Point), and in 1633 built a fort; but in 1635-36 English from Cambridge, Mass., settled along the river, and in 1637 named the place Hartford (from Hertford in England). In 1639 they adopted "the first written constitution" of the world, for which it has been sometimes called "the birthplace of American democracy." In 1654 the Dutch were ousted. For Andros' attempt on the charter in 1687, see CHARTER OAK.

The town's position as the distributing center for the Connecticut Valley (of great relative importance when all English settlement was east of the Alleghenies), and the capital of an important colony, made it early the seat of able businessmen, and a leading port of West India trade. Marine insurance on its cargoes ultimately developed its commanding insurance position of today. As the head of the one rich district in the Revolution which the British could not reach, it became the center of supply to the Revolutionary armies; and the second commissary general, Jeremiah Wadsworth, was a Hartford merchant. As a focus of New England Federalism in the War of 1812, it was in 1814 the meeting place (in the old

State House) of the HARTFORD CONVENTION. It was sole capital of Connecticut up to 1701; joint capital with New Haven to 1873; since then sole capital once more.

Between 1780 and 1800 a literary circle of professional men called the "Hartford Wits," who were either graduates of Yale or associated with it, met at Hartford and New Haven. The chief "Hartford Wits" were Joel Barlow, Timothy Dwight, and David Humphrey, and they did much to encourage poetry during the critical period of American history. The city numbers among its native and adopted citizens such illustrious names as Noah Webster, Henry Barnard, Frederick Law Olmsted, John Fiske, E. C. Steadman, John Trumbull, Harriet Beecher Stowe, J. G. Whittier, Charles Dudley Warner, "Mark Twain," Dudley Buck, Lydia Sigourney, and J. Pierpont Morgan.

**HARTFORD**, town, E Vermont, in Windsor County, on the White River, one mile above its confluence with the Connecticut River, 42 miles SE of Montpelier. Hartford was founded in 1761 by settlers from Lebanon, Conn. The town is a residential suburb of White River Junction. Pop. (1950) 5,827.

**HARTFORD CITY**, city, E central Indiana, county seat of Blackford County, on the Nickel Plate and the Pennsylvania railroads, 18 miles N of Muncie. It was established in 1837. The chief industries include the manufacture of paper, glass, hardware, and garage doors. Pop. (1950) 7,253.

**HARTFORD CONVENTION**, in U.S. history, a secret political convention that met at Hartford, Conn., from Dec. 15, 1814, to Jan. 5, 1815, at the suggestion of the Massachusetts legislature. It was composed of 26 Federalist delegates from Massachusetts, Connecticut, and Rhode Island, Cheshire and Grafton counties, N.H., and Windham County, Vt. GEORGE CABOT was president, and Theodore Dwight, secretary.

The conflict with Great Britain in 1812-14 had been opposed from the first by the Federalists of New England, whose commercial interests had been seriously damaged by the war and the Embargo Acts (see EMBARGO); and the Hartford Convention was called to devise means of security and defense, and safeguard the rights of the individual states. The convention accordingly prepared a report recommending that the state legislatures request the Federal government to turn over to them a reasonable proportion of the taxes collected within their borders, to be used for the defense of the state; and that the legislatures propose amendments to the Federal Constitution providing that representatives and direct taxes be apportioned among the several states "according to their respective numbers of free persons" (Negro slaves excluded); that a vote of two-thirds in Congress be required for the admission of a new state into the Union; for the interdiction of commercial intercourse between the United States and any foreign nation, or for the declaration of war against any foreign nation except in case of actual invasion; that Congress be prohibited from laying embargoes; that naturalized citizens be ineligible as members of either house of Congress, and incapable of holding any civil office under the United States; and that "the same person shall not be elected President of the United States a second time, nor shall the President be elected from the same State two terms in succession."

Peace was established before the convention adjourned, and no serious effort to secure the amendments was made. But the fact that the sessions of the convention were held behind closed doors created a strong suspicion of disloyal tendencies; and while no treasonable act or intent was ever proved against the convention, it hastened the fall of the Federalist party. See FEDERALIST PARTY.

**HARTLEPOOL**, seaport, resort, and municipal borough, England, in Durham, situated on a penin-

sula in the North Sea which shelters the harbor to the S. With West Hartlepool (now a county borough), Seaton Carew, Stranton, and Throston, Hartlepool forms a parliamentary district. Industries include iron, brass, and steel works, electrical supply factories, shipbuilding yards, boiler and engineering shops, flour and grist mills, lumber mills, and the manufacture of woollens, cottons, paper, paints, and soap. There are coal mines in the vicinity. The docks of West Hartlepool cover 350 acres and the port has a great trade in coal, timber, machinery, metallic goods, and textiles. In 1914, during World War I, Hartlepool, Scarborough, and Whitby were bombarded by German squadrons. During World War II Hartlepool and the port were attacked in a long series of raids by German flyers throughout 1940-41. Pop. Hartlepool, 17,217; West Hartlepool, 72,597.

**HARTLEY, DAVID**, 1705-57, English philosopher, was born near Halifax. He was educated at Cambridge University, where he studied at first for the church; but dissenting from certain doctrines to the Thirty-nine Articles, he turned to the profession of medicine, in which he attained considerable eminence. His fame rests chiefly upon the work *Observations on Man, His Fame, His Duty, and His Expectations* (1749), which exerted a strong influence on John Stuart Mill, and in which he explained mental phenomena as proceeding from molecular nervous vibrations and the principle of the association of ideas.

**HARTMAN, FRANK ALEXANDER**, 1883- , American physiologist and endocrinologist, was born in Gibbon, Neb., and studied at the universities of Kansas and Washington. He was head of the department of physiology at the University of Buffalo (1919-34) and at Ohio State University from 1934. In 1927 he obtained an extract, which he called cortin, from the outer layer, or cortex, of the ADRENAL GLANDS of cows. This hormone containing extract proved effective in prolonging the lives of those suffering from ADDISON'S DISEASE.

**HARTMANN, KARL ROBERT EDUARD VON**, 1842-1906, German philosopher, was born in Berlin. Educated for the army, he was forced to retire from the Prussian military service in 1865 because of an injured knee. In 1867 he received his doctor's degree from the University of Rostock and two years later he published his first book, *The Philosophy of the Unconscious*. Its immediate success was due to its pessimism, a fashionable attitude of the time. Stressing the Darwinian theory of evolution, von Hartmann tried to harmonize and reconcile philosophy with science by gathering the varied results of modern scientific investigation into an all-comprehensive philosophic conception of the world. He believed that only the development and spread of knowledge could free humanity from suffering in a world destined for misery. Happiness would come by freeing men from their illusions and enabling them to negate the will to live. Although strongly influenced by Schopenhauer, von Hartmann differed from his thought by making the deliverance of man depend on a remote collective experience of the race in the future, instead of on the present asceticism of the individual. He also substituted the concept of the unconscious for Schopenhauer's term, "will," by including both intelligence and will in the unconscious.

**HARTMANN VON AUE**, c. 1170-1210, German poet, appears to have been a Swabian by birth, a knight in rank, and a man of superior education for his age. He joined a crusade to the Holy Land, most likely that of 1197, and was living in 1210, but had died before 1220. We have from his pen lyrical poems, and four longer works: *Gregorius*, a tragic legend of the early life of Pope Gregory the Great; *Der arme Heinrich*, upon which Longfellow based his *Golden Legend*; *Erec*, and *Iwein*, two translations, or more correctly speaking, free renderings, of the *Erec* and *Chevalier au Lion* of Chrétien de Troyes. It was to these two poems that Hartmann principally owed



his contemporary popularity. His versions often present alterations, additions, and rearrangement of incident, the source of which it is not always easy to determine. Not only was Hartmann's style admirable, but he had a much keener sense of the unities than has Chrétien de Troyes, and a much greater faculty for telling a clear and probable story.

**HARTNETT, CHARLES LEO**, 1900–, American baseball player and manager, was born in Woonsocket, R.I. He was catcher for the Cubs (1922–40); voted the most valuable player in the National League (1935); appointed manager of the Cubs (1938); released as manager (1940) and joined the Giants as player-coach. He later managed minor league teams in Indianapolis and Jersey City.

**HART'S-TONGUE**, a rare FERN found in shaded ravines and under limestone cliffs, belonging to the family *Polypodiaceae*. Hart's-tongues, *Scolopendrium vulgare*, are characterized by bright green fronds with heart-shaped bases.

**HARTSHORN**, or **SPIRITS OF HARTSHORN**. See AMMONIA.

**HARTSHORNE, HUGH**, 1885–, American psychologist, was born in Lawrence, Mass., and studied at Amherst College and Yale and Columbia universities. After teaching religious education at Union Theological Seminary (1915–32) and at the University of Southern California (1922–24), and being research associate at Teachers College of Columbia (1924–29), he became research associate of religion at Yale in 1929. Known for research in character and personality, he devised a performance test (with Mark May) to study honesty as a personality trait. Also known for studies of standards and trends in religious education, he wrote: *Childhood and Character* (1919); *Studies in the Organization of Character* (with M. A. May, 1930). He edited *Theological Education in the Northern Baptist Convention* (1945).

**HARTSVILLE**, town, NE South Carolina, Darlington County; on the Atlantic Coast Line and the Seaboard Air Line railroads and U.S. Highway 15, about 70 miles NE of Columbia. The town was named for Thomas E. Hart, owner of the plantation on which Hartsville developed. The settlement grew up about a store, established in 1866 by Maj. James Coker of the Confederate Army; he also built a 10-mile railroad connecting with the Atlantic Coast Line and founded and endowed Coker College for women. To other members of the Coker family, who were agricultural experts, is due much of the prosperity of the town and the surrounding agricultural country. Hartsville manufactures textiles, paper cones, furniture, cotton oil, and fertilizer. Pop.(1950) 5,658.

**HARTWICK COLLEGE**. See COLLEGES.

**HARUSPICES**, soothsayers or diviners among the Etruscans, and from them adopted by the ancient Romans, who foretold future events from the inspection of the entrails of animals offered in sacrifice. They took indications also from earthquakes, lightning, and other extraordinary phenomena of nature called *portenta*. The haruspices did not equal the augurs in dignity and respect; they were regarded rather as mediums of communication with heaven than as possessing any independent religious authority; and they had no organization like the augurs. See DIVINATION.

**HARVARD, JOHN**, 1607–38, American clergyman, was born in Southwark, London. He was graduated from Cambridge University (1631), and was ordained a dissenting minister. In 1637 he came to New England, and settled in Charlestown, becoming freeman of Massachusetts Bay Colony. At his death, a year later, he left a bequest of one-half of his estate, as well as his library of some 400 volumes, to help endow the new school at Cambridge which the general court of the colony had provided for in 1636. The general court in 1639 ordered that the institution should be called Harvard College. See HARVARD UNIVERSITY.



**HARVARD COLLEGE OBSERVATORY**  
The Coronagraph Building at Climax, Colorado, station has a conical roof to shed the heavy snows

**HARVARD COLLEGE OBSERVATORY**. The astronomical department of Harvard University has its headquarters at Cambridge, Mass., where it was founded in 1843, but its observing stations are now located at Harvard, Mass., Climax, Colo., and near Bloemfontein, South Africa. Research and student instruction are carried on in most fields of astronomy, with special attention to stellar photography, photometry, spectroscopy, variable stars, solar studies, comets and meteors, and galaxies. In addition, Harvard serves the astronomical world as clearinghouse for astronomical news in the Western Hemisphere, distributing to other observatories and the public current and spot news of such events as discoveries of comets, asteroids, and new stars.

At both its northern and southern observing stations, the entire sky is repeatedly photographed with small cameras of short focal length. These patrol-camera photographs, covering relatively large areas of the sky on each plate, are constantly resorted to by astronomers everywhere as the only records of certain astronomical happenings, and for obtaining the history of a particular object or star over long periods. The patrol-camera plates, together with photographs by larger instruments, including two 60-inch reflecting telescopes, and one Schmidt-type camera of 24 inches aperture, form the largest collection of astronomical photographs in the world, nearly half a million plates in all. The detailed study of this collection has resulted in many important discoveries, such as of new variable stars, novae, the eighth and ninth satellites of Saturn, and the period-luminosity relation of Cepheid variable stars.

Of great importance to astronomers are Harvard's great catalogues of the photometric and photographic magnitudes and the spectral types of hundreds of thousands of stars. With the installation of new telescopes of the Schmidt type at both northern and southern stations, Harvard astronomers are carrying this work to fainter and fainter stars in large regions of the sky.

Jointly with the University of Colorado, Harvard maintains a high altitude station at Climax, where are located coronagraphs designed for observing the prominences and corona of the sun day by day, without benefit of a total solar eclipse. These studies are important in correlating changes on the sun and in its atmosphere with changes in weather and radio communications conditions in the earth's atmosphere.

Internationally, Harvard co-operates with observatories in Holland, Ireland, Mexico, and many other countries, on both observational and research programs. Its American Association of Variable Star Observers comprises amateur and professional observers the world over, who in four decades have amassed over a million estimates of the magnitudes of variable stars, 40 per cent of these estimates having been made in foreign countries. C. A. FEDERER, JR.

**HARVARD UNIVERSITY**. The oldest institution of higher education in the United States, Harvard College was founded on October 28, 1636, by a vote of the General Court of the Massachusetts Bay Colony. A house and land were obtained in the

village of Newtown, the name of which was changed in May, 1638, to Cambridge, in honor of the English university. Instruction began in the summer of 1638 on the site of what is still the College Yard. In March, 1639, the General Court voted to name the institution in honor of JOHN HARVARD, a Puritan minister who on his death in September, 1638, at the age of 31, left half his estate—a sum of about £780—and over 400 books to the college.

Henry Dunster, the first president, was appointed in 1640. Two years later the first class was graduated. The same year, 1642, the court acted to define the nature of the Board of Overseers, and in May, 1650, the college was chartered by the court and Governor Dudley. An appendix to the charter was added in 1657. As chartered, the governing authority of the college was placed in a board known as the Corporation, consisting of the president, five fellows, and the treasurer of the college. The Corporation was to be self-perpetuating, and, with the exception of two intervals between 1686 and 1707, has been the controlling body of the university for almost 300 years.

The growth of Harvard has paralleled much of the cultural and political history of eastern United States. From the first, instruction was given in the arts, languages, and philosophy, with the B.A. and M.A. degrees being granted. The course of study was similar to that of the English universities. Degrees in divinity were granted, starting in 1692. After the Revolutionary War, the chartered rights of the Corporation were guaranteed in the constitution of Massachusetts (1780). The gradual transition from Harvard College to the Harvard University of today was brought about through the power of the Corporation and the emergence of the university as an independent institution, virtually free of the strong influence of church and state which had affected its policy in the 18th century. In 1810 the Massachusetts Legislature passed an act which changed the composition of the Harvard Board of Overseers, providing that the majority of its members be elected by the board itself. In 1851 the tie with the church ended when the requirement that 15 of the overseers be Congregational ministers was dropped. After 1865 state officers were no longer ex-officio members of the board, and the way was clear for the new voting rules, adopted in 1921, which called for the election of the overseers by the alumni, regardless of their place of residence.

The present organization of the university consists of a Faculty of Arts and Sciences, comprising Harvard College and the Graduate School of Arts and Sciences, and the various other faculties and schools which have been added to the university since its founding. The Divinity School dates from 1816 and the Faculty of Theology from 1819, although theological studies were included in the original curriculum of the college. The Law School, founded in 1817, is the oldest now in existence in the United States. The Faculty of Medicine, located in Boston, contains both the Medical School, established in 1782, and the School of Dental Medicine which succeeded the Harvard Dental School in 1941. A School of Public Health grew out of the work of the Medical School, becoming an independent unit in 1922. Instruction in engineering and applied science has been carried on at Harvard since 1847 when the Lawrence Scientific School was established. In 1906 this school ceased to exist, and, following the reorganization of instruction, the Graduate School of Engineering was opened in 1934. The Faculty of Engineering dates from 1918. The Graduate School of Business Administration was opened in 1908; the Graduate School of Education was organized as a separate unit in 1920. A Faculty of Design dates from 1936. Plans for a Graduate School of Public Administration began in 1935; and the School was established in 1937.

Special fellowships and numerous institutions for advanced study and research have made Harvard an outstanding center for investigation in all areas of

human activity. The Society of Fellows provides young men with an opportunity to spend three to six years in advanced research projects free of academic requirements and the need of self-support. The Lucius W. Nieman Fellowships in Journalism, founded in 1937, enables experienced journalists to spend a year at Harvard studying whatever subjects they desire to further their education. The Trade Union Fellowship Project, begun in 1942, provides advanced education for responsible labor leadership through fellowships supported by unions and the university in co-operation.

In addition to the special libraries and laboratories for scientific research, the university museum of the biological sciences, geology, and mineralogy, including the Peabody Museum of Archaeology and Ethnology, is a center for advanced study in these fields. Three outstanding museums of art, the Semitic Museum (1889), the William Hayes Fogg Art Museum (1895), and the Germanic Museum (1902) are located at the University. The Harvard University Press publishes outstanding scholarly publications.

Among the distinguished Americans who have taught at Harvard are Henry Wadsworth Longfellow, Oliver Wendell Holmes, Jean Agassiz, William James, George Santayana, Harvey Cushing, and Samuel Eliot Morison. Under such presidents as CHARLES W. ELIOT and his successor, ABBOT LAWRENCE LOWELL, in the decades between 1890 and 1930, the graduate and undergraduate facilities of the university developed from those of a college to the present extensive plant. Harvard became less a regional school and began to draw its students from the nation as a whole. The elective system, introduced by Eliot, spread from Harvard to higher institutions and secondary schools all over the world. The "house plan" and the tutorial system, established in Lowell's administration, were also influential. James B. Conant, who was elected president of Harvard in 1933 after serving as professor of chemistry, led in the further expansion of the university and, as a result of such investigations as were reported in *General Education in a Free Society* (1946), modified the elective system to require basic courses in the humanities, social, and natural sciences for undergraduate students.

Radcliffe College for women, founded in 1879, is located in Cambridge adjacent to Harvard. Their close relation led to a formal constitutional union of the two schools in 1943. Separate instruction is provided in lower level courses, but for advanced work and graduate study Radcliffe students are admitted to the classes at Harvard. Thus, although still nominally restricted to men, instruction throughout the university is essentially coeducational. See COLLEGES. AND UNIVERSITIES.

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**HARVARD UNIVERSITY LIBRARY**, the oldest library in the United States, had its beginning in 1638 in Cambridge, Mass., when JOHN HARVARD (1607–38), an immigrant Puritan minister in America, bequeathed £780 (half his estate) and his library of several hundred books to a newly founded "schoale or colledge" in a township named Cambridge. The library had increased to some 5,000 by 1764 when fire destroyed all but one of the original volumes. Since then it has about doubled its size every 20 years. The largest university library in the world, it contained 5,397,286 volumes in 1950. Its book expenditures for that year amounted to \$525,109, and its salary outlay was \$846,895. Many valuable and rare volumes are housed in the Harvard College Library (headquarters) and the 75 departmental collections connected with the law school, the Arnold Arboretum, the Gray Herbarium, the Bussey Institution, the Astronomical Observatory, the Meteorological Observatory, the Peabody Museum, the Museum of Comparative Zoology, and the schools of theology,



medicine, dentistry, engineering, business administration, architecture, landscape architecture, education, and others. In 1915 the Widener Memorial building was completed. This building, which houses about two million volumes, was erected by Mrs. George D. Widener in memory of her son, Harry Elkins Widener, a graduate of Harvard who lost his life in the sinking of the *Titanic*. More than 100,000 rare books and manuscripts have the benefit of clean air with regulated humidity and temperatures in the new Houghton Library, completed in 1942, which is connected with the Widener building by a tunnel and a bridge. Rare books include more than 2,600 volumes printed before 1501. The collection of manuscripts and editions of John Keats is outstanding, as are the collections of other English and American authors and theater material.

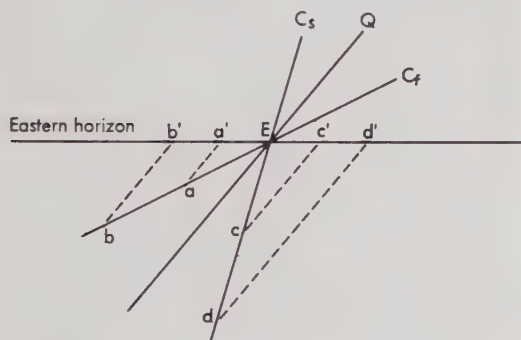
MILDRED OTHMER PETERSON

**HARVEST AND HARVESTING.** See AGRICULTURE; FARM MACHINERY.

**HARVEST FLY,** a name applied to several species of CECADA.

**HARVEST MITE.** See CHIGGER.

**HARVEST MOON,** the full moon that falls nearest September 23. At this time of year, in northern



Harvest Moon

In the diagram, *E* is the east point of the horizon and *EQ* is the position of the celestial equator at latitude  $40^\circ$  N. On a night near the end of September the full moon rises at sunset at *E*. By the next sunset it has moved, very nearly along the ecliptic *EC*, to the point *a*, and rises at *a'* only after being carried along *aa'*, parallel to *EQ*, by the westward diurnal rotation of the heavens. By the second sunset the moon is at *b* and traces the diurnal path *bb'* before rising. When a full moon rises at sunset at *E* in late March, however, the position of the ecliptic is *EC<sub>s</sub>*, and the greater interval between sunset and moonrise on the next two evenings is shown by the longer diurnal paths *cc'* and *dd'*.

latitudes and near the time when it is full, the moon rises only a few minutes later each night than the night before, thus giving bright moonlight early in the evening and all night on several successive nights. Since the moon moves eastward among the stars more rapidly than the sun, there is a retardation in its rising, from one day to the next, that averages about 50 minutes throughout the year. The daily retardation is variable because the moon's speed in its orbit is variable and because its path is inclined to the celestial equator (compare with the true solar DAY); it may be as little as 13 minutes or as great as 80 at latitude  $40^\circ$ , with a still greater range at higher latitudes. When the full moon is rising about September 23 it is near the vernal equinox (the sun is at the autumnal equinox), and the ecliptic, which is approximately the moon's path, is south of the celestial equator and makes a smaller angle with the horizon than at any other time of year. For this reason the daily retardation of the harvest moon is less than for any other full moon of the year. See HUNTER'S MOON; PHASE.

A. T. M.

**HARVESTING MACHINERY.** See FARM MACHINERY.

**HARVEY, GABRIEL**, 1545?-1630, English poet, born at Saffron Walden, Essex. He became an intimate friend of Spenser, was the Hobbinal of *The Shepherdes Calender*, and engaged in a fierce paper war with Greene and Nashe, the satirists. After Nashe's famous *Have with you to Saffron Walden* (1596), and Harvey's *Trimming of Thomas Nashe* (1597), all the books were forbidden by authority (1599).

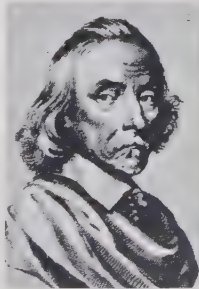
BIBLIOG.—E. G. Harman, *Gabriel Harvey* (1923).

**HARVEY, Sir GEORGE**, 1806-76, Scottish painter, was born in St. Ninians, near Stirling. Largely a self-taught artist, he received his only training at the Trustee's Academy near Edinburgh. Most of his subjects were purely Scottish in origin. Scottish history, as in "Last Sleep of Argyll" (1841), the Scottish landscape, as in "Glen Falloch," and Scottish genre themes, as in "The Curlers," are all represented. One of the founders of the Royal Scottish Academy, Harvey became a fellow in 1826 and its president in 1864.

**HARVEY, GEORGE BRINTON McCLELLAN**, 1864-1928, American journalist and diplomat, was born in Peacham, Vt. After reporting on several newspapers and being managing editor of the *New York World* (1891), he bought the *North American Review* in 1899. As president of Harper and Brothers he edited the *Review* and *Harper's Weekly*, using the latter to help obtain for Woodrow Wilson the Democratic nomination for governor of New Jersey. After a split between the two men before Wilson became president, Harvey fought his policies. In 1920 he aided Warren G. Harding's Republican nomination for the presidency and was appointed ambassador to Britain (1921-23).

**HARVEY, WILLIAM**, 1578-1657, English physician, the discoverer of the circulation of the blood. He was born in Folkestone, Kent, and studied at Cambridge. In 1602 he received a degree in medicine at Padua, which was then a famous center of medical education. In 1609 he was appointed physician to St. Bartholomew's Hospital, London. For 40 years (1616-56) he held the appointment of Lumleian lecturer on anatomy and surgery at the Royal College of Physicians, London. From 1618 to 1625 he also served as physician extraordinary to James I, and from 1625 to 1644 as physician in ordinary to Charles I, whose interest in Harvey's research continued throughout this period.

It is difficult now to appreciate fully how revolutionary Harvey's discovery of the circulation of the blood appeared when he published his treatise on it in 1628. Until then the world accepted many of the ideas of GALEN, including his misconceptions concerning the heart and blood vessels which even the challenging work of Vesalius had failed to dislodge. Galen had taught that the liver manufactured the blood; that blood coming from the liver into the right side of the heart made the heart pulsate, seeped through "pores" into the left side of the heart, and then into the vessels; and that in the vessels the blood moved to and fro until it was absorbed by the tissues and organs.



JOHN CRERAR LIBRARY

William Harvey

Harvey attacked this explanation by experiment and proved by mathematical calculation that it was untenable. He demonstrated that if only newly produced blood left the heart, the body would have to produce and consume two or three times its own weight in blood every hour. Since this is obviously not true, Harvey suggested that the blood must flow in a continuous circuit through the heart, into the

arteries, into the veins, and back to the heart. Harvey's discovery of what is now common knowledge indicates his ingenious deduction from external evidence, for he never saw the capillaries and thus could not show how the blood can pass from the arteries into the veins. This final proof of the validity of Harvey's deduction was not possible until the introduction of the microscope made the capillaries visible. See MALPIGHI, MARCELLO; ARTERIES, VEINS, AND CAPILLARIES.

Harvey's treatise on the action of the heart and movement of the blood in animals (*Exercitatio anatomica de motu cordis et sanguinis in animalibus*), which he dedicated to Charles I, has been called the greatest book in medical literature. Harvey's duties at the court occupied much of his time for the next 16 years, although he continued his careful observations. After the Royalists were defeated, he went to Oxford and devoted his time to studies of the embryological development of animals, described in his *De generatione animalium* (1651). See EMBRYOLOGY; HARVEY AND MODERN PHYSIOLOGY (Back End Papers, Vol. 11).

**HARVEY**, town, NE Illinois, in Cook County, situated on the Illinois Central, the Grand Trunk, and the Baltimore and Ohio Chicago Terminal railroads; 15 miles S of Chicago. It is a residential suburb of Chicago and has foundries, machine shops, and factories producing gas and oil well apparatus, steel cars, foundry equipment, railroad supplies, road building machinery and motor trucks. There are stone quarries in the neighborhood. Harvey was founded in 1890 and incorporated in 1895. Pop. (1950) 20,683.

**HARVEYZED STEEL**. See ARMOR PLATE.

**HARWICH**, seaport, naval base, and municipal borough, England, in Essex, 70 miles NE of London, on a peninsula at the junction of the Stour and Orwell rivers. Harwich harbor is one of the best on the east coast of England; it is also one of the chief English ports for continental passenger traffic and the terminus for the Harwich-Zeebrugge train ferry service. Harwich has a large continental trade, exporting cement, horses, and fish. Its chief industries include cement works, shipbuilding yards, and shrimp and lobster fisheries. Dovercourt, a residential suburb, is a favorite seaside resort. Off the town, Alfred's fleet encountered the Danes in 885, and in 1666 a naval engagement took place between the Dutch and English. An important naval base in both World Wars, Harwich suffered heavy damage from German flyers in 1940-41. Pop. (1950 est.) 12,075.

**HARZ MOUNTAINS**, mountainous region in N Germany, at the S edge of the great N German plain; measuring 55 miles from WNW to ESE and 20 miles from N to S. It falls steeply on all sides, but more especially on the north, where a raw climate prevails. The general altitude is from 2,000 to 3,500 feet, but the BROCKEN culminates in 3,750 feet. The mountains are politically divided among the states of Prussia (provinces of Saxony and Hanover), Brunswick, and Anhalt. A region well-forested, mostly with conifers, and abounding in wells and brooks, it was the last stronghold of paganism in ancient Germany. It is, therefore, richly endowed with the wild and gloomy associations of the Teutonic imagination. Goethe used the Harz Mountain folklore in several scenes of his *Faust*; the mountains are immortalized in his *Harzreise im Winter*, and Heinrich Heine's *Harzreise*. Many places in the Harz Mountains offer mineral waters, pine needle and saline baths, and whey-cures. The town of Rübeland is famous for its extensive stalactite caves. The region is one of the main winter sports areas in northern Germany as well as a summer resort, and several railways afford access to the mountains. Mining for silver, copper, and lead has been carried on for hundreds of years, but most of the mines are now exhausted. Some sulfur, alum, and arsenic are obtained, and there are quarries of marble and

granite. There are sawmills and manufactures of paper and wood products. Peat digging, lacemaking, and the breeding of canary birds are local activities, and cattle raising on the mountain pastures is important. During World War II it was Adolf Hitler's plan to make the Harz Mountains the final German redoubt in the north. However, invasion of the region by U.S. forces simultaneously from the northwest at Goslar and from the southeast at Nordhausen (Apr. 11-12, 1945) rendered Hitler's plan useless.

**HARZBURG**, often called **Bad Harzburg**, favorite summer resort of the Harz Mountains, Germany, located in the state of Brunswick (Braunschweig), at the north foot of the BROCKEN, 28 miles by rail south of Brunswick. It is famous for its horse races, possesses saline waters, and is overlooked by the Burgberg (1,520 ft.), crowned by the ruins of a castle built by the Emperor Henry IV in the 11th century. Pop. about 6,000.

**HASA**, or **El Hasa**, province, a part of the kingdom of Saudi Arabia, stretching S along the W coast of the Persian Gulf, from the frontiers of Kuwait to Oman, its average width 50 miles; area 22,500 sq. mi.; pop. about 75,000. It was a tributary of Turkey from 1819 to 1914, when it was taken by Saudi Arabia. The coast is low, flat, and composed mostly of sand dunes. There are five ports: Jubail, Qatif, Oqair, Ras at Tannura, and Saihat. The chief towns are HORUF and Mubarratz. The Great Oasis of Hasa produces wheat, rice, dates, cotton, and indigo. Domestic animals raised for market are Arabian horses, white donkeys, and camels. The chief importance of the province lies in its oil deposits. Some of the richest oil fields in the world are at and around DHAHRAN. The peninsula of QATAR, which encloses the Gulf of Bahrein on the south, geographically forms a part of Hasa, but is independently administered.

**HASBROUCK HEIGHTS**, borough, NE New Jersey, Bergen County, on the New Jersey and New York Railroad, about 30 miles SE of Paterson in the New York metropolitan area. The borough was founded in 1685 by the Kip family but was named for another Dutch colonist. Pop. (1950) 9,181.

**HASDRUBAL**, d. 221 B.C., ancient Carthaginian general, was the son-in-law of HAMILCAR BARCA. On the latter's death in 228 B.C., he succeeded to the chief command in Spain. He founded New Carthage, and made a treaty with the Romans by which the Ebro was fixed as the boundary between the Carthaginian and Roman spheres of influence.

**HASDRUBAL**, d. 207 B.C., ancient Carthaginian general, son of HAMILCAR BARCA and the brother of HANNIBAL, by whom he was left in command of Spain when Italy was invaded in 218 B.C. He fought for years against the two Scipios; and in 207 B.C. invaded Italy to aid Hannibal, but before he could join his brother he was defeated by Claudius Nero and Livius at the Metaurus and killed. See PUNIC WARS.

**HASHEMITE KINGDOM OF THE JORDAN**. See TRANS-JORDAN.

**HASHISH**. See CANNABIS.

**HASIDIM**, or Chasidim, a Jewish sect or party, which became prominent in the Maccabean wars (I Macc. 2:42, 7:13; II Macc. 14:6), although they had existed previously. They were strongly religious and conservative, and are regarded by some as the chief agents in causing the war. Later records do not mention them, but some later writers believe they reappeared in the Essenes, and others that they developed into the Pharisees (see ESSENES; PHARISEES).

Hasidim, "saints" or "holy men" in a later age, were the leaders of a Jewish revivalist faith that sprang up in southern Russia in the eighteenth century out of the warm, mystical teachings of the Baal Shem Tov. Many rabbis had gone to pedantic extremes in their emphasis on Talmudic learning. Hasidim taught that God is as close to the ignorant as to the wise. The Hasidic development gave rise to a Yiddish literary renaissance. A. L. SACHER



**HASSMONAEANS.** See MACCABEES.

**HASSALL, ARTHUR,** 1835–1930, English historian. In 1880 he succeeded Herbert Gladstone in charge of history work at Keble College, and from 1883 to 1924 taught at Christ Church. His principal works include *The Balance of Power* (1869), being sixth in the "European History from 476 to 1920" series, of which he was editor, and numerous books on British and French history.

**HASSAM, CHILDE,** 1859–1935, American painter and etcher, was born in Boston. He studied in Paris and brought to American art the influence of impressionism and an original style. Among his paintings are "The Summer Sea" and "The Butterfly."

**HASSAN,** 625–669, and **HUSSEIN,** or Hosien, 629–680, sons of Ali and Fatima, the daughter of Mohammed. Hassan was proclaimed caliph at Kufa on the death of his father in 660, but made terms with his rival, Moawiya, and retired to live a religious life at Medina. His brother Hussein, of a more warlike temper, succeeded him as imam of the Shiites (see SHIITES), and claimed the reversion of the caliphate.

**HASSELT,** city, SE Belgium, capital of Limburg Province, on the Demer River, 19 miles W of Maastricht. Hasselt has breweries and distilleries and its position near the Kempen (Campine) coal field has made it one of the centers of the growing Limburg industrial region. In World War II the city was liberated from German control on Sept. 10, 1944. Pop. (1955) 33,564.

**HASSLER, FERDINAND RUDOLPH,** 1770–1843, first superintendent of the U.S. Coast Survey, born in Aarau, Switzerland. From 1807 to 1809 he was professor of mathematics at West Point, and from 1811 served on the U.S. Coast Survey, of which he became superintendent in 1815. The survey work was discontinued in 1818 but resumed in 1832, and occupied him the remainder of his life. He published mathematical textbooks, and a *System of the Universe* (2 vols. 1828).

**HASTIE, WILLIAM HENRY,** 1904–, American Negro jurist, was born in Knoxville, Tenn., and studied at Amherst College and the Harvard University Law School. After being judge of the district court of the Virgin Islands (1937–39), he became dean of the Howard University Law School (1939). In 1946 he was appointed governor of the Virgin Islands by President Truman, and served until 1950. He was named judge of the Third U.S. Circuit Court of Appeals in 1949, the first Negro to hold such a high judicial office.

**HASTINAPUR,** ruined city, India, in United Provinces, 22 miles E of Meerut. Once the capital of the Pandava kingdom, it is celebrated in the *Mahabharata*.

**HASTINGS, FRANCIS RAWDON, 1st MARQUESS OF HASTINGS** and 2nd **EARL OF MOIRA,** 1754–1826, English general and administrator. He went to America in 1773, and fought at Bunker Hill. He was captured (1781) by a French cruiser on his homeward voyage, but was released by exchange of prisoners. He was dispatched to Holland with 7,000 men to reinforce the duke of York (1794). Appointed in 1812 governor general of Bengal and commander in chief of India, his rule opened with two campaigns against Nepal; he crushed the Pindaris, and by his defeat of the chief of Nagpur and Holkar, secured for Britain supremacy and extension of territory. For these services he was created marquess of Hastings (1817).

**HASTINGS, THOMAS,** 1860–1929, American architect, was born in New York City. He studied under Jules André at the École des Beaux-Arts, Paris, and in 1884 entered the office of McKim, Mead, and White. From 1886 to 1911 he was a partner in the firm of Carrère and Hastings, which was responsible for such structures as the Ponce de Leon Hotel, Florida, the Senate and House office buildings,

Washington, D.C., and the New Theater and New York Public Library, New York City. After Carrère's death, Hastings' work became more classical and less French in inspiration, as in the Richmond County Court House, Staten Island, N.Y., and the Frick House, New York City. In 1922 he was presented the Royal gold medal of the Royal Institute of British Architects.

**HASTINGS, WARREN,** 1732–1818, British administrator in India, was born in Churchill, Oxfordshire, of the old but impoverished family of Hastings of Daylesford. His parents died soon after his birth, and he passed his early years with his grandfather, Penyston Hastings, rector of Daylesford. In 1740 his uncle, Howard Hastings, sent him to Westminster School. He went to Calcutta in 1750, in the service of the East India Company, and returned to England 14 years later "honourably poor" (Macaulay), despite the opportunities of exploitation offered by India. Evidence given by Hastings on Indian affairs in the House of Commons (1766) attracted the notice of the directors of the EAST INDIA COMPANY, who in 1769 sent him to India as a member of the Council of Madras. In 1771 he exchanged this post for the governorship of Bengal. He became governor general of the British administration by the Regulating Act of 1773. In his term of office he did much to consolidate the Indian empire. Although his conduct in certain cases may have been irregular, his motives were probably not those of personal gain. He made an enemy of Philip Francis, another council member, and on his return to England in 1785, the Whig opposition, instigated by Francis, vehemently denounced his administration in India, carrying a motion for his impeachment in 1787. The trial began in Westminster Hall on Feb. 13, 1788, with EDMUND BURKE, CHARLES JAMES FOX, Sheridan, and Windham leading the impeachers. Hastings was unanimously acquitted after seven years' trial, which cost him £70,000—the bulk of his fortune. In 1804 the East India Company granted him a pension, and in 1813, when he appeared before a committee in the House of Commons, the entire House stood bareheaded to acclaim him. The House of Lords gave a similar demonstration the next day. Macaulay's famous *Essay on Warren Hastings* is too partisan to be of much historical value. See INDIA, History.

**HASTINGS,** municipal and county borough, one of the CINQUE PORTS and a seaside resort, England, in Sussex, on the English Channel, 33 miles E of Brighton and 60 miles SE of London. The town stretches west to St. Leonards, the two fronted and connected by shore promenades and two large piers. The churches of All Saints and St. Clements date from the 11th and 13th centuries. The suburb, West Cliff, has the ruins of a Norman castle. The decisive battle of the Norman Conquest was fought here Oct. 14, 1066, between William the Conqueror and Harold II, the Saxon King (see HASTINGS, BATTLE OF). Hastings suffered heavy damage, in 1940–41 during World War II, from air raids. Pop. (1951) 65,506.

**HASTINGS,** town, New Zealand, North Island, in Hawke Bay Provincial District, 12 miles by rail S of Napier, on the Ngaruroro River. It is a center of a prosperous agricultural district. Originally called Heretaunga, its name was later changed to Hastings in honor of Warren Hastings. Pop. (1955 est.) 19,800.

**HASTINGS,** city, Michigan, county seat of Barry County, on the Thornapple River and the New York Central Railroad, 40 miles SW of Lansing. Hastings was settled in 1836. A resort situated in farm country, Hastings makes furniture, auto accessories, fire sprinkling apparatus, and machine shop products. Pop. (1950) 6,096.

**HASTINGS,** city, Minnesota, county seat of Dakota County, on the Mississippi River at the mouth of Vermilion River, the Burlington and the Milwaukee railroads, and U.S. Highway 61; about 20 miles SE

of St. Paul. Hastings was first permanently settled in 1850 and named for Gen. Henry Hastings Sibley. One of the points of interest in the city is a spiral bridge that crosses the Mississippi at this point. Hastings makes flour, butter, sprayers, filing equipment, and skis. Pop. (1950) 6,560.

**HASTINGS**, city, S Nebraska, county seat of Adams County, on the Burlington, the Missouri Pacific, and the Union Pacific railroads, and U.S. highways 6, 34, and 281; about 96 miles SW of Lincoln. Hastings, the fourth largest city of the state, is situated in the central South Platte region in the heart of the great Kansas-Nebraska wheat belt. It was settled in 1871 by Walter Micklen. Hastings College is located here. Air conditioning, auto accessories, canvas goods, farm tools, trailers, and bricks are made in Hastings. Pop. (1950) 20,211.

**HASTINGS, BATTLE OF**. On Sept. 28, 1066, WILLIAM, Duke of Normandy, landed at Pevensey Bay to enforce his claim to the English crown. The English king, HAROLD II, took up a strong position on the hill of Senlac to dispute William's advance. On the morning of October 14 the Normans attacked Harold's position, but were repeatedly driven back, and at one time it was supposed their duke had fallen. At length, by a feigned flight, William drew the English from their stockade, which was attacked on the flanks, and the position carried. See **BATTLES**, **DECISIVE**.

**HASTINGS COLLEGE**. See **COLLEGES**.

**HASTINGS-ON-HUDSON**, village, New York, Westchester County, on the E bank of the Hudson River, the New York Central Railroad, and U.S. Highway 9, adjoining Yonkers, which is on the S. Although settled in the 17th century, the village was incorporated in 1879 and named for the English birthplace of William Saunders, a local manufacturer. Factories of the village produce copper cable and dyes. Many residents commute to New York for business. Pop. (1950) 7,565.

**HASWELL, CHARLES HAYNES**, 1809-1907, American mechanical engineer, was born in New York City. Entering the Allaire works about 1827, he became chief draftsman and designer of steam engines. In 1836, when the navy decided to change from sail to steam, Haswell was commissioned to design the engines for the frigate *Fulton*. His success in designing and installing machinery on the *Mississippi*, *Michigan*, *Missouri*, and other vessels led to his appointment as chief engineer of the U.S. Navy (1844-52). On his retirement from the navy he acted as surveyor of steam vessels for marine underwriters in New York, Boston, and Philadelphia (1852-93) and as consulting engineer to the New York Board of Public Improvements (1898-1907). His *Mechanics' and Engineers' Pocket Book* (1842) has been issued in several score editions since.

**HAT AND HAT MANUFACTURE**. A hat differs from a cap or bonnet in that it has a continuous brim. A cap has a brim, or peak, on only the foremost part, and a bonnet is entirely without a brim or peak. The *petasus*, or traveling hat, of the ancient Greek was the forerunner of present day styles in men's hats. This Greek headcovering was made of felt, broad brimmed and was held firmly on the head by a cord passing under the wearer's chin or behind his ears.

The early history of hats has been varied and colorful. Numerous garish and contrasting styles came into vogue, from the extravagantly ornamented hats (with feather plumage and costly jeweled clasps) of early French and English nobility to the large, comparatively simple beaver hats originating during Queen Elizabeth's reign. Quaker and Puritan hats were extremely plain, high of crown and with a stiff brim. "Cocked hats" of the 18th century had portions of their brims looped up in "cocks." The high crowned silk hat appeared in 1810. The derby hat was first made in the United States in 1850. An English hat clerk suggested calling it the derby, after

the famous English horse race. The style became popular.

The soft felt, stiff felt (derby), stiff straw, pliable straw (Panama), and silk hat form the five principal types worn at the present time. Women's hats are made of similar materials in factories and individual shops. Rough hat bodies are bought. These are shaped, blocked, trimmed, and styled according to the prevailing "fashion." It is not a mass producing, stabilized industry as is manufacture of men's hats. See **MILLINERY**.

**Manufacture**. The hat industry in America began in Colonial times. In 1662 the Assembly of Virginia passed a law offering 10 pounds of tobacco for every good fur or wool hat made in the colony. By 1730, so great a number of hats were being made in the American Colonies that the English hat manufacturers obtained a law forbidding the importation of hats from the Colonies.

With the advent of labor and time-saving machinery in 1820, the hat industry in the United States began turning out greater quantities. After the Civil War, the industry expanded still further and grew to such proportions that the United States is now a large exporter of hats. The leading manufacturing centers of the hat industry are in Philadelphia and New York City. Other important hat-producing cities are Orange and Newark, N.J., Norwalk and Danbury, Conn., Brooklyn, N.Y., and Reading, Penn.

**Felt Hats** are, by a wide margin, the most popular type of hat manufactured in the United States. Rabbit fur, or cony, from which most of the felts are made, is largely imported. Other furs used include muskrat and beaver. The more expensive grades of felt hats are made entirely of cony, or that of beaver or nutria (fur of the coypu) or a combination of all three. The medium grades are made of fur and wool, while the cheapest hats use wool alone.

**Straw Hats** are of two types; the oval, flat-crowned stiff straw and the Panama hat. The latter is a pliable straw hat, woven of shredded "straw" obtained from the leaves of a shrub (*toquilla*). The weaving of this straw produces a linen-like cloth. Most of these hats are made in Colombia or Ecuador. Those few actually being made in Panama sell at a lower price.

The bodies of these hats are woven on blocks, the finer hats requiring up to six months to complete. They are given their final form by being pressed into shape.

The stiff straw hat is made from imported straw braids which come from Italy or China. After bleaching in the sun and whitening in sulfur fumes, the braids are sewed together by machinery. The straw braids are spiraled in widening circles until enough material is thus obtained to make up a hat. These braids, or plaits, are lapped by the machine method, or in more expensive models, sewn edge to edge by hand. The straw is then stiffened with a gelatin size or waterproof gum and blocked into shape by hydraulic or vacuum machines.

**Silk Hats** are made of bleached cotton and muslins, which are first stiffened with shellac and then cut into sections making up crown, side, and brim. These sections, of several thicknesses each, are sewed, cemented with shellac and ironed so as to form one unit. The hat is then covered with silk plush, trimmed, the brim is bound and curled, and with the insertion of the lining the hat is finished.

**Opera Hats** are similar to silk hats in shape and in construction of brim and tip. There the similarity ends, however, as the crown covers a metallic mechanical frame which can be extended or closed at will. Merino, corded silk, or satin is used for covering this portion.

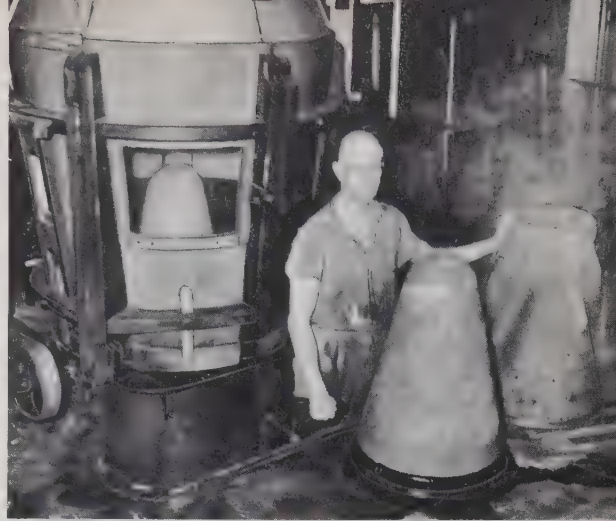
**HATAY**, or **Alexandretta**, a province of S central Turkey, which extends along the SE shore of the Gulf of Alexandretta; bounded on the N by the Turkish provinces of Maras, Gaziantep, and Seyhan





KNOX HATS

**Fur**, an important element in making of good felt, is cut from pelts and sorted according to quality



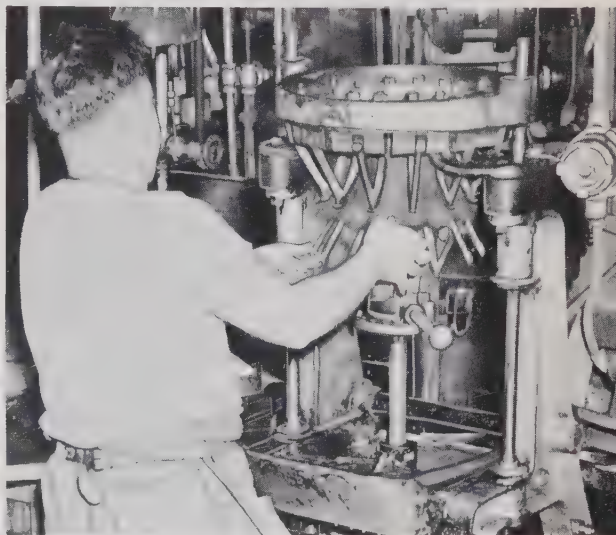
KNOX HATS

**Hat Bodies**, cut from fur felt material, receive the first shaping on cones of the forming machines



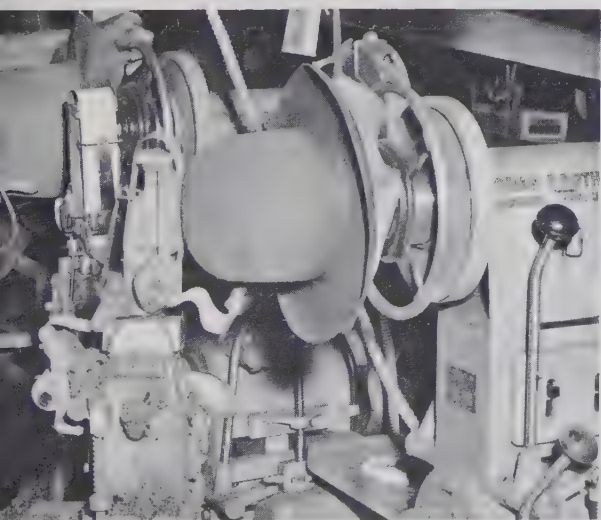
KNOX HATS

**Shrinking of the hat body** is the next process



DOBBS HATS

**Hat body** is stretched and brim is formed



DOBBS HATS

**Felt** is then pumiced to the desired finish



DOBBS HATS

**The hat**, complete with band and stitched brim



(Adana); on the E by the republic of Syria; on the S by the autonomous territory of Latakia; and on the W by the Mediterranean; area 2,600 sq. mi.; pop. (1945) 254,141. The Afrine, the largest river, flows east and southwest through Lake d'Amouk and empties into the Mediterranean at Soueidie. Hatay, formerly the Syrian administrative district (sanjak) of Alexandretta, was under Turkish rule until after World War I, when it was mandated to France. Turkey, however, claimed the territory because the population was principally Turkish. Negotiations between Turkey and France continued before the League of Nations until the final agreement signed at Ankara on June 23, 1939, transferred the sanjak to Turkey.

**HATCH, WILLIAM HENRY**, 1833-96, American legislator, was born in Scott County, Ky., was admitted to the bar in 1854, and was elected circuit attorney of the 16th judicial circuit of Missouri in 1858 and 1860. He reached the rank of lieutenant colonel in the Confederate army, and served in Congress for eight successive terms as a Democrat. He was especially interested in agricultural measures, and fathered what has since been called the Hatch Act, giving Federal aid to agricultural stations throughout the country. See **AGRICULTURAL EXPERIMENT STATIONS**.

**HATCH ACTS**, two laws passed by the U.S. Congress to restrict and control the political activities of members of the Federal civil service and also to prohibit certain other corrupt practices. These laws, sponsored by Senator Carl A. Hatch and passed in 1939 and 1940, reinforce and extend the Federal **CORRUPT PRACTICES ACT**. The first, entitled "An Act to prevent pernicious activities," was designed primarily to prevent abuses such as had been reported by the Sheppard Senate committee in connection with the congressional campaign of 1938, when great numbers of people were on relief rolls. The act (1) protected persons on the Federal pay roll against intimidation or coercion in connection with voting at elections; (2) prohibited solicitation or receipt of political contributions from relief workers or persons receiving Federal relief; (3) forbade the use of relief funds to coerce voters; and (4) made it unlawful for any person to promise any employment or other benefit as a reward for political activity or for support of, or opposition to, any candidate or political party in any election. The act further forbade officers and employees of the United States—except only those occupying policy-determining positions—to take any active part in political management or political campaigns, or to use their official authority with a view to affecting in any way "the election or nomination of any candidate" for a Federal office.

The second Hatch Act (1940) extended the ban on partisan coercion, campaign assessments, and political activity to cover employees of state and local governments if engaged in full-time activities financed wholly or in part by Federal funds. Such employees may not use their official authority in such ways as to interfere with any presidential or congressional nomination or election. The act also made it unlawful for any person whose *principal* employment is in a Federally aided activity (a) to use official authority or

influence for the purpose of interfering with any Federal nomination or election, (b) to coerce, command, or advise any other such employee to make a political contribution or loan, and (c) to take any active part in political management or a political campaign.

The second Hatch Act is also notable for its drastic changes in the regulations governing campaign funds. Besides prohibiting the purchase of commodities or advertising, when the proceeds of such purchase are to be used for political purposes, the act limited receipts by any political committee operating in more than one state, and likewise expenditures by such committee, to an amount aggregating \$3,000,000 in any calendar year. At the same time, individual contributions or loans for use in any campaign for the nomination or election of Federal officers were restricted to \$5,000 each in any calendar year.

At its first test (in the elections of 1940), the portion of the law relating to contributions and expenditures proved so full of loopholes, arising from vague phraseology and specified exceptions, that its practical effect was almost negligible. Mushroom organizations, acting independently of the regular national committees, collected and expended sums far in excess of the \$3,000,000 permitted; and persons who had contributed or loaned \$5,000 to a national committee made even heavier contributions to state committees, which then used the funds previously assumed by the national committees. The 1944 presidential campaign provided additional evidence of the ineffectiveness of the Hatch Act. See **CORRUPT PRACTICES ACT**; **PARTY, POLITICAL**; **ELECTION**; **POLITICAL MACHINE**.

P. ORMAN RAY

**HATCHERY**, a place for hatching eggs of fish or fowl. The baby chick industry, turkey and duck farms, and Federal and state government fish conservation areas use hatcheries. Many states use hatcheries to hatch game bird eggs.

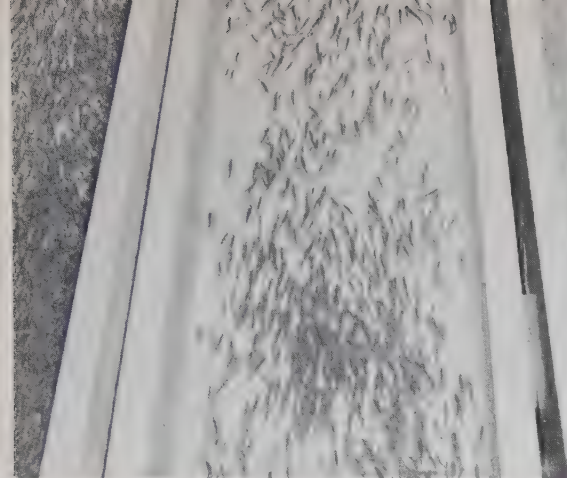
**Chick Hatcheries.** Large breeding flocks are maintained in connection with chick, turkey, and duck hatcheries. The fertile eggs of the hens are first placed in an **INCUBATOR**, various types of which hold 600 to 30,600 eggs each and are electrically or gas heated. Some models turn the eggs automatically, thus warming them uniformly during the incubation period. After remaining in the cabinet-like machine until hatching time, (two "settings" or hatchings a

**Newly-Hatched Chicks** are transferred from an incubator tray to a special shipping box. Trays, upper right, are filled with incubating eggs

U.S.D.A.







U.S. FISH AND WILDLIFE SERV.

Fingerling Trout, kept in rearing troughs in a hatchery, will be shipped to stock U.S. waterways

week are usually obtained), the eggs are removed to a separate cabinet, known as the hatcher. The trays here are deeper to accommodate the newly hatched chicks when they emerge from the shells. Some models have sliding trays while others have trays arranged on a wheel-like affair within the cabinet, rotating so that each tray can be reached through a door.

After hatching, the baby chicks are placed in a "brooder," an electric, oil, or coal heated shedlike arrangement, furnishing a uniform temperature of 90° to 100° F. which is required to keep the chicks healthy and active. The greatest number of chicks are hatched during March, April, and May. Hatcheries employ specially trained men and women to determine the sex of baby chicks soon after hatching. Speed in this operation is essential as the chicks cannot be sold until they have been classified, and they arrive at their destination in much better condition when shipped soon after being hatched.

**Fish Hatcheries**, under Federal and state supervision, and also operated by private companies, extend across the United States. There are 99 Federal fish-cultural stations in 43 states and 522 state-owned fish hatcheries and rearing stations. Oregon has the largest number of state hatcheries. Washington and Wisconsin rank second and third in number of hatcheries. Besides those state and federally owned, there are also privately operated fish hatcheries. They hatch such cold water species as trout (rainbow, brook, black spotted, German Brown, lake, Loch Leven, and steelhead), sockeye salmon, and grayling. Warm water species includes bullheads, catfish, crappie, large and small mouth black bass, pickerel, pike, perch, rock bass, sunfish, and yellow perch. These can be purchased in five sizes: eggs, fry, fingerling, market fish (sold as food), and adult warm water fish.

The Fish and Wildlife Service is the Federal agency concerned with the conservation and propagation of the nation's fish life. The Service owns railroad cars for transporting fish and fish eggs, and a steamship, the *Fishhawk*, which is literally a floating hatchery. Streams almost exhausted have been restocked; eastern and western fish have been shipped to opposite ends of the nation. Fish are not released in public waterways until they have reached a "legal" size.

For many years fish hatcheries more or less produced fish with little regard to improving the catch records of fishermen. Today the state conservation departments and the Federal Service are more concerned with the returns of hatchery-produced fish to fishermen's creels than with rearing fish to show high production in official reports. The field of fisheries management for the purpose of improving fishing has within recent years taken on great significance and overshadows production of fish in

## Hate

hatcheries. However, it is generally recognized that hatcheries are a necessary tool in the management program. The hatchery fish are used for stocking new waters, waters which have become barren through winterkill or other uncontrollable factors, and for the introduction of predatory species which in turn control large numbers of forage fish. Trout are used mainly for put-and-take fishing, and salmon are stocked to increase Pacific Coast commercial runs.

Fish eggs can be fertilized after leaving the fish by artificial means. Taking the ova from female fish and mixing them with milt taken from the male accomplishes this. Thus the artificial propagation, fertilization, breeding, rearing, and protection of fish by Federal and state agencies helps assure a plentiful supply of fish in the nation's waterways, ponds, and streams, for both commercial and angling purposes. U.S. salmon breeding establishments in Maine and California furnish many pounds of food fish. Lobsters, oysters, and other shellfish are also raised in various parts of the country.

### OUTPUT OF FISH AND FISH EGGS BY FEDERAL HATCHERIES DURING 1949

| SPECIES                | TOTAL       |
|------------------------|-------------|
| Bass, Largemouth Black | 9,108,017   |
| Bass, Rock             | 17,585      |
| Bass, Smallmouth Black | 732,142     |
| Bass, Striped          | 339         |
| Bass, Warmouth         | 64,040      |
| Bluegill               | 33,344,659  |
| Catfish                | 321,005     |
| Catfish, Channel       | 233,736     |
| Crappie, Black         | 104,052     |
| Crappie, White         | 6,829       |
| Flounder               | 545,871,000 |
| Grayling               | 1,727,595   |
| Lobster                | 206,000     |
| Perch, Yellow          | 31,515      |
| Pike, Northern         | 11,293,763  |
| Pike, Wall-eyed        | 2,269,100   |
| Salmon, Atlantic       | 324,489     |
| Salmon, Chinook        | 44,479,898  |
| Salmon, Chum           | 12,269,724  |
| Salmon, Kokanee        | 480,873     |
| Salmon, Sebago         | 57,638      |
| Salmon, Silver         | 504,423     |
| Salmon, Sockeye        | 6,400,859   |
| Shad                   | 22,879,000  |
| Sunfish, Green         | 500         |
| Sunfish, Red-ear       | 165,998     |
| Trout, Blackspotted    | 21,150,785  |
| Trout, Brook           | 14,191,868  |
| Trout, Brown           | 2,058,493   |
| Trout, Lake            | 66,654      |
| Trout, Rainbow         | 19,215,241  |
| Trout, Steelhead       | 114,020     |
| Grand Total            | 749,691,840 |

A policy of exchange of fish and fish eggs between state and Federal hatcheries exists. Thus some species difficult to procure by some states are obtained through Federal hatcheries.

R. W.

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**HATE** is an emotional attitude characterized by ill will and a desire to inflict injury upon someone. Hate on the surface is the opposite of love, yet fundamentally they are so closely related that a person can

alternate between them. If the love impulse for a person is once frustrated, it is doubtful that one can ever be completely neutral to that person. Often it will be changed into hate. Cases are well known in which hate for a person has been transformed into love. This is not so strange as it might seem when it is realized that one can have ambivalent feelings for the same person; love him for some characteristics and definitely dislike him for others. Hate in some cases may be the preponderance of aversion and enmity over attraction and affection. See **EMOTION**; **AGGRESSION**.

J. L. HIRNING

**HATFIELD**, town, England, in Hertfordshire, on the Lea River, 18 miles N of London. A Jacobean manor, Hatfield House, is now a museum containing relics of Tudor times, such as the casket letters of Mary, Queen of Scots. Edward VI and Elizabeth were both living here when called to the throne. Pop. about 10,000.

**HATFIELD-McCOY FEUD**, the most famous of the family vendettas of the southern Appalachians. The Hatfields lived around Williamson, W. Va., while the McCoy's lived just across the state line in Kentucky. The animosity dated back to the time of the Civil War, but did not reach the feud stage until 1882, when Johnse Hatfield attempted to elope with Rosanna McCoy. In the family fracas which resulted Ellison Hatfield was shot. Three McCoy brothers were arrested by Kentucky authorities, but as they were being escorted to the jail at Pikeville they were taken from the sheriff by a band led by "Devil Anse" Hatfield; the prisoners were carried off into the West Virginia jurisdiction, and after Ellison's death were rowed back across the river to be brutally murdered on Kentucky soil. During the years following many killings were perpetrated, the McCoy's suffering the most. Since each clan controlled the local government in its own jurisdiction it was difficult to settle the issue through the ordinary channels of justice; moreover, the two governors refused to honor extradition requests. Finally in 1888 Kentucky authorities made several raids into West Virginia, killing at least two Hatfields and capturing nine others, two of whom were executed and the others sent to prison. In that year the leaders of the McCoy clan, sick of the killings, moved to Pikeville. The last outbreak occurred in 1896. "Devil Anse" Hatfield died in 1921 in his 80's; as a final gesture of family pride and defiance to their enemies the kinsmen erected a statue of their feud leader. See **FEUD**.

F. M.

**BIBLIOG.**—Virgil C. Jones, *The Hatfields and the McCoy's* (1948).

**HATHAWAY, ANNE**, 1556–1623, wife of **SHAKE-SPEARE**.

**HATIEN**, town, S Vietnam, in Cochin China, about 155 miles WSW of Saigon, on the coast of the Gulf of Siam. Most of the inhabitants are Chinese. Exports include fish and pepper.

**HATTERAS, CAPE**, E North Carolina, separated from the mainland by Pamlico Sound. Heavy storms are common in the area, making this a dangerous point for shipping. Here is located the Cape Hatteras National Seashore Recreational Area, of more than 23,000 acres, taken over by the National Park Service in 1953.

**HATTIESBURG**, city, SE Mississippi, seat of Forrest County, on the Leaf River; the Bonhomie and Hattiesburg Southern, the Illinois Central, the Mississippi Central, and the Southern railroads; and U.S. highways 11 and 49; about 70 miles N of Gulfport. Hattiesburg, situated in the heart of a yellow pine region, is the trade center for an agricultural community. It was founded in 1881 by Capt. William H. Hardy, pioneer lumberman, and named for his wife. The Mississippi Southern College, a coeducational teachers college, is located here. Lumber, lumber products, silk, chemicals, naval stores, paint, concrete pipes, and roofing are the chief products. Pop. (1950) 29,474.

**HATTO I**, c. 850–913, archbishop of Mainz, was appointed Abbot of Reichenau (888) and archbishop of Mainz (891). Legend has it that he was devoured by mice for scoffingly comparing the cry of the poor to the squeak of mice.

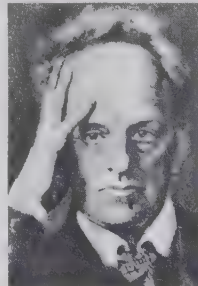
**HATTO II**, d. 970, archbishop of Mainz, became abbot of St. Boniface in 942 and archbishop of Mainz and imperial chancellor in 968. The mouse legend sometimes connected with Hatto I is more generally applied to Hatto II. It points to a reputation for oppression of the poor and probably grew out of the corruption of the name *Mauturm* (Toll-tower) into *Mäuseturm* (Mouse-tower) in the Rhine near Bingen. According to legend he fled to that tower before an army of mice invading Mainz; they pursued him and devoured him in the tower.

**HAUFF, WILHELM**, 1802–27, German author, was born and died in Stuttgart. Though he lived only 25 years, he wrote fairy tales, poems, a few short stories, a novel *Lichtenstein* (1826), and a fantasy called *Phantasien im Bremer Ratskeller* (1827). These earned him an enduring place in German literature.

**HAUGESUND**, town and seaport, SW Norway, in the N part of Rogaland County, about 30 miles NW of Stavanger, across the Boknfjord. The town is situated on the west coast opposite the northern end of Karmo Island and has a well sheltered harbor. Its chief importance is as a fishing port; herring is the principal catch. There are a shipbuilding yard, fish canneries, and factories manufacturing woolsens and margarine. Canned, salted, and fresh fish are the chief exports. Haugesund is the reputed place of the death of Harald Haarfager; in 1872 an obelisk 56 feet high was erected upon his supposed grave mound, in celebration of the thousandth year of Norway's existence as a kingdom. Pop. (1950) 18,747.

**HAUPT, HERMAN**, 1817–1905, American engineer and inventor, was born in Philadelphia and in 1835 was graduated from West Point. Three months later he resigned his commission and entered engineering work, becoming superintendent of transportation of the Pennsylvania Railroad (1849), general superintendent (1850–52), and chief engineer (1853–56). He supervised the construction (1856–62) of the Hoosac tunnel (see **HOOSAC MOUNTAINS**). During the Civil War he was chief of construction and transportation on U.S. military roads. He supervised construction for the Tidewater Pipe Line Company and was general manager of the Northern Pacific Railroad (1881–84). Having previously invented a drilling machine using compressed air, he introduced compressed air for motors and mining machinery as president of the General Compressed Air and Power Company (1892–1905). He wrote *General Theory of Bridge Construction* (1851), *Military Bridges* (1864), *Street Railway Motors* (1893).

**HAUPTMANN, GERHART**, 1862–1946, German novelist, born in Salzbrunn, Silesia. He studied art in Breslau and Dresden, and philosophy and natural science at the University of Jena, and eventually settled in Erkner, a suburb of Berlin. *Before Dawn* (1889), his first play, a sensational experiment in the naturalistic drama, won him the enmity of orthodox critics and the enthusiastic support of young German writers. He continued this naturalistic vein in *The Weavers* (1892), a powerful proletarian drama; in *Der Biberpelz* (1893), a comedy; and in *Florian Geyer* (1895), a tragic epic. He found his destined genre, however, in the lyric drama—in such symbolic fantasies as *Hanneles Himmelfahrt* (1893), *The Sunken Bell* (1896), and *Und Pippa tanzt* (1906)—most of his later plays



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and novels (*The Fool in Christ: Emanuel Quint*, 1910; *The Heretic of Soana*, 1918; *The Island of the Great Mother*, 1925) were characterized by poetic mysticism. His legend as a radical intellectual persisted for many years, but he was in fact an aristocratic recluse who tranquilly survived the vicissitudes of the Weimar Republic and Hitler's Reich, honored and befriended by Ebers and ignored or belittled by the Nazis. In 1912 he was awarded the Nobel prize for literature.

J. J. M.

**HAURAN**, Roman *Auranitis*, a province of S Syria, lying E of the Jordan, SE of Mt. Hermon, bounded on the N by Trachonitis, NW by Gaulanitis and Batanaea; area 50 sq. mi. Hauran proper includes Jedur, Jaulan, and part of the hill country south of the Yarmuk; the name is also applied to the area extending east of Jaulan to the desert and from the district of Damascus to the Yarmuk. In Ezek. 47: 16-18, it denoted the fine agricultural plain forming the eastern half of Bashan. It was conquered first by the Israelites, later by the Romans, and A.D. 632 by the Arabs. Ruins of hundreds of Greco-Roman towns are still to be seen.

**HAUSAS**, or **HOUSSAS**, a West African people. Their language, a variety of the Hamitic group, but with a strong Semitic tinge, is "a sort of *lingua franca*" in central and west Sudan, between Lake Chad and the Niger. Of medium height and black complexion, they represent perhaps the highest Negro type, and have long had a native civilization. They have a written character, a modified form of Arabic writing; their literature includes poems, ethical sayings, legal documents, and history; and their language is spoken by over 3,125,000 people in the Hausa States. They teach their children to read and write. Many of them hold the faith of Islam, formerly imposed upon them by the FULAHs, but their earlier heathenism still survives. They mine iron, tin, silver, lead, and salt; they are excellent farmers, conspicuous as traders, and experts in cotton spinning, weaving, and dyeing. Although naturally peaceful, they make admirable soldiers, being distinguished by great physical strength, coolness, and bravery. As early as 1874 they fought as allies of the British against the Ashantis.

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**HAUSER, KASPAR**, 1812-33, a German youth who appeared in Nuremberg in 1828, after apparently having been confined in a dungeon as long as he could remember. Some people thought that Hauser was the prince of Baden, taken from his cradle and kidnaped while a dying child was put in his place. In this way the younger (morganatic) branch of the House of Baden came to the throne. Hauser was taken under the protection of the Earl of Stanhope, but died under mysterious circumstances, after a gunshot wound. Numerous books have been written about the affair. Jacob Wassermann wrote a famous novel, *Kaspar Hauser*.

**HAUSHOFER, KARL**, 1869-1946, German geopolitician, was born in Munich. Joining the German army, he was for several years a military observer in Japan and served on the western front during World War I. Following the armistice he became a professor at the University of Munich, where he set forth his philosophy of geopolitics and developed a large group of followers. In 1924 he began the publication of the *Journal of Geopolitics* and later established an Institute of Geopolitics to carry out research and planning in many related fields. Haushofer's doctrines were taken over by the Nazis and the institute was adopted by the German government, playing a large role in research and propaganda activities. In June, 1945, Haushofer was seized by American military authorities but was released, and later committed suicide. See **GEOPOLITICS**.

**HAUSSMANN, GEORGES EUGÈNE, BARON**, 1809-91, French prefect and city planner, was born in Paris and entered the prefectorial service in 1831.

He became prefect of the Seine in 1853. His plans for the rebuilding of Paris, carried out in his administration, included building wider streets and spacious boulevards, open plazas and public parks, new public buildings, and a new water supply and sewage system. Haussmann was dismissed from office in 1870 after wide criticism of the heavy expenses of his projects. His *Mémoires* were published (1890-93).

**HAUT-RHIN**, department of E France, Upper Alsace, bordered on the E by the Rhine River and on the S by Switzerland; area 1,354 sq. mi.; pop. (1946) 471,705. It is drained by the ILL RIVER, an affluent of the Rhine, and by its tributaries and has an elaborate canal system linked to the extensive Rhine-Rhône Canal. The VOSGES MOUNTAINS lie in the western area of the department and extend northward to Bas-Rhin. The mountains are covered with rich growths of forests, chiefly oak, beech, and fir. The farming area of the department is fertile, and potatoes, corn, flax, and grapes are grown. The textile industry is the most important in the department, centering chiefly in COLMAR, MULHOUSE, and Guebwiller. Besides textiles, the manufactures include pottery, bricks, chemicals, paints, and machinery. There are wineries, breweries, distilleries, and cheese factories. Colmar is the capital.

As an integral part of Alsace, the greater part of Haut-Rhin was incorporated into Germany in 1871 as a consequence of France's defeat in the Franco-Prussian War. The rest of the department remained in French hands and was renamed "the Territory of BELFORT." When, after World War I, Alsace-Lorraine was reunited with France, the Territory of Belfort remained a separate administrative unit. Lost again by France in 1940, Haut-Rhin was retaken by Allied forces late in 1944, when a crucial struggle there cleared the Germans from the west bank of the Rhine.

**HAUTE-GARONNE**, department, SW France extending along the Upper Garonne, bounded on the N by Tarn et Garonne and Tarn; E by Aude and Ariège, S by Spain, and W by Hautes-Pyrénées and Gers; area 2,458 sq. mi.; pop. (1946) 512,260. In the south the Pyrenees reach heights of 10,000 feet; the northern part is lower, with a mild climate. The Canal du Midi crosses the department, and there are numerous irrigation canals. Zinc, lead, and salt are mined; and there are marble quarries in the vicinity of St. Béal. The water power of the Pyrenees has created new chemical industries, and there are manufactures of paper, textiles, bricks, leather, iron, and copper. Livestock raising is important, and wheat, corn, fruit, and vegetables are grown. The capital is TOULOUSE.

**HAUTE-LOIRE**, department of S central France; bounded on the N by Puy de Dôme and Loire, E by Ardèche, S by Lozère, and W by Cantal; area 1,931 sq. mi.; pop. (1946) 228,076. It is traversed from north to south by four mountain chains which reach their highest point in Mont Mezenc (5,755 ft.) in the southeast. The LOIRE drains the eastern part and the ALLIER the western. Coal and antimony are mined; cereals and potatoes are grown; stock raising is extensively carried on; and lacemaking, brewing, and paper making are important industries. The capital is Le Puy.

**HAUTE-MARNE**, department, E France, bounded on the N by Marne and Meuse, E by Vosges and Haute-Saône, S by Côte d'Or, and W by Côte d'Or and Aube; area 2,415 sq. mi.; pop. (1946) 181,840. The MARNE RIVER divides the department. The highest land is in the south in the Plateau de Langres, where the Marne and the Aube have their sources. The MEUSE flows through the eastern part, and the canal connecting the Marne with the Saône is navigable. Forests cover a large part of the surface. The soil is poor for the most part, with rye and potatoes the chief crops. Sheep are raised, and some wine is produced. There are large

deposits of iron, and building stone is quarried. Manufacturing and trade center around St. Dizier in the north. The capital is CHAUMONT.

**HAUTE-SAÔNE**, department, E France, bounded on the N by Vosges, on the E by the Territory of Belfort, S by Doubs and Jura, and on the W by Côte d'Or and Haute-Marne; area 2,075 sq. mi.; pop. (1946) 202,573. The Saône River which traverses the department from north to south, is navigable in its canalized stretches; the Ognon forms the greater part of the southern boundary. Forests cover about a fourth of the land. Wheat, corn, oats, rye, potatoes, and fruit are grown; and there are vineyards in the southwest. Coal and rock salt are mined, and building stone is quarried. Manufactures include cotton spinning, metal working, paper making, and distilling. The capital is Vesoul.

**HAUTE-SAVOIE**, frontier department, France, bounded by the S shore of Lake Geneva on the N, Switzerland and Italy on the E, and the departments of Savoie on the S and Ain on the W; area 2,775 sq. mi.; pop. (1946) 270,468. The surface is mountainous, culminating in the southeast in the range of Mont BLANC (15,782 ft.). Haute-Savoie is traversed by the RHÔNE and the Arve rivers. Cattle raising and forestry are the most important occupations, and wine, cereals, and fruit are produced. Anthracite and asphalt are mined. Manufacturing is of little importance. The department is a favorite tourist resort, CHAMONIX, St. Gervais, and Sallanches being within its borders. The capital is Annecy.

**HAUTE-VIENNE**, department, central France, bounded on the N by the departments of Indre and Vienne, W by Charente, S by Dordogne and Corrèze, and E by Creuse; area 2,119 sq. mi.; pop. (1946) 336,313. The Blond and Ambazac hills and the Monts du Limousins diversify the surface. The chief river is the Vienne. In general the soil is unproductive, but some cereals are grown. Chestnuts are a staple crop; and cattle, sheep, and pigs are raised. Kaolin, used in the porcelain works of Limoges, and granite are quarried. There are breweries, tanneries, and manufactures of wool materials and agricultural implements. The capital is LIMOGES.

**HAUTES-ALPES**, department of SE France, on the Italian frontier, bounded on the N by Isère and Savoie; E by Italy, S by Basses Alpes, and W by Vaucluse and Drôme; area 2,178 sq. mi.; pop. (1946) 84,932. The surface is mountainous; Pointe des Écrins (13,462 ft.), the loftiest peak of the Dauphiné Alps, is the highest point. The chief rivers of Hautes-Alpes are the Drac and the DURANCE. The forests have been almost wholly destroyed by vast herds of sheep and cattle. Argentiferous lead, marble, and coal are mined. There are no manufacturing industries of importance. The capital is Gap.

**HAUTES-PYRÉNÉES**, frontier department of France; on the Spanish border, bounded on the W by Basses-Pyrénées, N by Gers, and E by Haute-Garonne; area 1,750 sq. mi.; pop. (1946) 201,954. The southern part is mountainous, culminating in the Vignemale (11,000 ft.), the loftiest peak of the Pyrenees in France, and the northern and central parts consist of plains and hills. The chief rivers are the Gave de Pau, the ADOUR, and the Neste. Slate, lignite, lead, manganese, and zinc are mined, and mineral springs are numerous. Cereals and fruit are grown; wine is produced; cattle and a very fine breed of horses are raised. There are flour mills, sawmills, paper mills, tanneries, and manufactures of wool, looms, and agricultural implements. The capital is TARBE.

**HAÛY, RENÉ JUST**, 1743–1822, French physicist and mineralogist, was born in Saint Just. He prepared for the priesthood and took orders. Turning his attention to mineralogy, he discovered the geometrical law of crystallization (1781); this set forth the proposition that the cleavage of a crystal could be explained by the fact that it is composed of small

parallelepipeds. Abbé Haüy also discovered the geometrical identity of beryl and emerald. He became curator in the School of Mines (1794) and professor in the Paris Museum of Natural History (1802). Elected to the Academy of Sciences (1783), he wrote *Traité de minéralogie* (4 vols. 1801) and *Traité de cristallographie* (2 vols. 1822).

**HAÛYNITE**, or **HAÛYNE**, a complex calcium aluminum silicate which occurs in igneous rocks, particularly those rich in sodium. It is commonly found in rounded grains resembling crystals with fused surfaces, blue to greenish blue in color. Under the microscope it is colorless or pale blue, isotropic, and frequently filled with minute enclosures of glass or minerals arranged in lines parallel to the faces of the crystal. It is found in the ejected blocks of Vesuvius, in certain volcanic rocks of Italy, at the Laacher See, near Mainz, and in Montana. Nosean, Sodalite, and LAPIS LAZULI are closely related to haüynite.

**HAVANA**, or **Habana**, capital and chief city of Cuba and the capital of the province of Havana, on the N shore of the island, near the W end; 90 miles S of Key West, Fla. Pop. (1943) 676,376.

Havana is beautifully situated on a narrow peninsula bordered by the sea on the north and the bay on the east; its multicolored buildings stretch up to an amphitheater of hills. The harbor, more than three miles long, is one of the finest in the world, protected by Punta Castle on the west and MORRO CASTLE and La Cabana on the east. The city is built in two sections; the old city dates from the 16th century, with picturesque, crooked streets; the new, modern city of wide tree-shaded boulevards, parks, plazas, and brilliant flower gardens is dominated by the towering castle of El Principe. Many of the streets are bordered by large villas set in quaint old gardens.

The subtropical climate is hot except when relieved by northerly winds, although Havana is especially pleasant in winter, when the temperature ranges between 58° and 78° and averages 70°. The rainy season extends from May to November. The city has frequently been severely damaged by subtropical hurricanes. Stringent sanitary reforms enforced during the U.S. occupation have wiped out yellow fever and have helped to make Havana one of the cleanest of American cities.

Havana is the focus of the Central Highway, which traverses Cuba, and the center of air traffic in the Caribbean region. The Pan American Airways serve the city and local air lines also cover the island. The water supply of Havana comes from Vento springs through a 12-mile aqueduct named for the planning engineer, Albear.



An Old World scene in modern Havana

CUBAN TOURIST COMMISSION





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### The stately Presidential Palace in Havana

**Features of Interest.** Among the notable buildings are the stately capitol, built of Cuban marble and set in one of the formal gardens for which the Cubans are famous; the Presidential Palace; and the sumptuous Club Gallegos, containing the national theater. The picturesque gray cathedral, dating from the 17th and 18th centuries, is still called the Columbus Church because it once treasured bones believed to be those of Columbus; these were however, removed to Spain in 1898 (see CIUDAD TRUJILLO). The governor's palace, completed in 1790, is Havana's finest example of colonial architecture. The three ancient fortresses are other notable Cuban landmarks; La Punta, with eight-foot stone walls, was constructed in the 16th century; El Morro, begun in 1590, contains a labyrinth of dungeons and passageways; La Cabana, built about 1763, was never used in the defense of the city, but the cannon formerly used to recall to their barracks the soldiers garrisoned there is still shot each evening at nine o'clock.

Among the beautiful drives in Havana is the delightful Malecón, which curves between the city and the sea. Havana's numerous parks and plazas are gay with flowers and fountains. As a monument to international friendship a ceiba tree in the Plaza de la Fraternidad grows in soil gathered from the 21 American republics. The chief educational institution is the University of Havana, founded by the Dominicans in 1670. Free primary schools are provided and attendance is compulsory. There are secondary, normal, and vocational schools.

**Industries.** As the chief trading center of the island, Havana handles 80 per cent of the imports and 30 per cent of the exports of Cuba. Sugar is the chief export; other exports include raw and manufactured tobacco, coffee, rum and some pineapples, citrus fruits, and garden vegetables. Imports include cereals, vegetable oils, cheese, and canned fish and vegetables. The city has the great majority of the island's cigar and cigarette factories. There are also textile mills, packing and canning plants, foundries, machine shops, tanneries, and factories making shoes, paint, pharmaceuticals, soap, cosmetics, and rubber and paper goods.

Business conditions in Havana have closely followed the fluctuations in Cuba's sugar market. World War I brought a boom in which bank deposits and real estate shared. A falling sugar price in the depression of the 1930's created acute economic difficulties, but prices again went up during World War II. The tourist trade is a very important industry. Havana's large hotels, amusement places, and shops cater to a growing clientele of international visitors. The attractions include races, carnivals, concerts, theaters, and beach pleasures, as well as sightseeing.

**History.** Havana was settled (1514) by Diego de Velázquez on the south coast of Cuba and was moved to its present situation four years later. It has been the scene of much turbulence; has been burned by pirates (1528); has been sacked (1555; 1563); was

## Haverhill

attacked by Drake (1585) and by the Dutch (several times in the 17th century), and captured by the English in 1762 and in 1763 restored to Spain. The blowing up of the United States battleship MAINE in the harbor on Feb. 15, 1898, precipitated the SPANISH-AMERICAN WAR, in which the city and harbor were blockaded. In 1912 the remains of the battleship were removed and sunk in the ocean by the U.S. government. Measures were adopted providing for the provisional administration by the American republics of any dependent American territory endangered by dispute between non-American states. Significant inter-American conferences on education, radio communication, municipal problems, public welfare, and intellectual co-operation have been held at Havana. See CUBA, *History*.

F. C. W.

**HAVEL RIVER**, Germany, rises in a lake in the state of Mecklenburg, flows S as far as Potsdam, being joined by the Spree River at Spandau on the outskirts of Berlin, thence W finally NW, joining the Elbe a few miles above Wittenberge. The Havel is 220 miles long and navigable for most of its length. Above Spandau it enters a long chain of numerous lakes which are favorite places for sailing in summer and ice-sailing in winter. It is connected by canals with the Elbe and the Oder and is itself in part canalized. The area of the Havel's basin is 10,159 square miles.

**HAVELOCK**, Sir HENRY, 1795-1857, English soldier, was born in Bishop Wearmouth, Durham. He first saw active service in Burma (1825-26). In the Afghan campaign he was present at the storming of Ghazni and the occupation of Kabul in 1839; he served also in the Mahratta and Sikh wars and the Persian expedition. Ordered to relieve Cawnpore and Lucknow during the SEPOY MUTINY, he defeated the rebels at Fatehpur and Pandu Nadi on July 13, 1857, and seven days afterward at Unao, and entered Lucknow, Sept. 25, 1857, in the residency of which he was himself besieged for nearly two months. There he died of dysentery. He wrote *Memoir of the Campaign in Ava* (1828) and *Narrative of the War in Afghanistan* (1840).

**HAVELOK THE DANE, THE LAY OF**, a 14th-century narrative poem in English, describes the adventures of Havelok, son of the king of Denmark. Persecuted, and deprived of his inheritance by his guardian, Godard, he escapes to England where he works as a scullion in the house of Earl Godrich. To degrade his ward, Goldborough, daughter of the king of England, Godrich marries her to Havelok. When his royal destiny is revealed to him in a dream, Havelok, with the help of Grim the Fisherman, sails to Denmark, slays Godard, and regains the kingdom. He then returns to England with the Danish army and after imprisoning Godrich (who is finally burnt at the stake), he assumes the crown with Goldborough and they rule triumphantly for 60 years. Tradition associates the story with the founding of Grimsby, in England. Havelok has been identified with Anlaf Curan, the son of a Viking chieftain who ruled Northumbria early in the 10th century.

**HAFERFORD**, township, SE Pennsylvania, in Delaware County, served by the Pennsylvania Railroad, and located in the Philadelphia Metropolitan District. This residential community, settled by Welshmen in the 1680's, is the seat of Haverford College for men. The oldest astronomical observatory in Pennsylvania was created here in 1852. Pop. (1950) 39,641.

**HAFERFORD COLLEGE.** See COLLEGES.

**HAFERHILL**, city, NE Massachusetts, in Essex County, at the head of navigation on the Merrimack River, 15 miles from the Atlantic Ocean, on the Boston and Maine Railroad, 33 miles N of Boston. Haverhill is an important industrial city, the center of shoe manufacturing for 150 years. It is known as the "Queen Shoe City of the World." There are 50 shoe factories and over 100 plants manufacturing

shoe accessories such as lasts, ornaments, and wood and leather heels. Other important manufactures are boxboards, hats, vending machines, woollens, leather, pharmaceutical supplies, and communication equipment.

Haverhill is the seat of the Bradford Junior College, one of the oldest schools for girls in the country, founded as an academy in 1803. The city is the birthplace of the poet, John Greenleaf Whittier, whose home is preserved as a memorial. The Haverhill Public Library is rich in souvenirs of Whittier and contains a complete and valuable collection of first editions of his works. Buttonwoods is the headquarters of the Haverhill Historical Society, which houses a museum of many Indian relics.

Haverhill was founded in 1640 by Rev. John Ward and his 12 followers from the market town of Haverhill, England. The land was bought from the Indians for £3,10s., and the original deed is preserved by the Haverhill Historical Society. During the first years of its settlement Haverhill was the scene of frequent Indian attacks, the most famous of which occurred in 1697 when HANNAH DUSTIN was carried off. On Aug. 29, 1708, a party of Indians attacked the village and killed or carried off 40 inhabitants. Haverhill celebrated its tercentenary in 1940. It is one of the few cities in the East with a commission form of government. Pop. (1950) 47,280. A. M. K.

**HAVERS, CLOPTON**, c. 1655–1702, British physician and anatomist, practiced his profession in London. He gave special attention to anatomy, embodying his ideas in *Osteologia Nova; or, Some New Observations of the Bones* (1691). This work was the earliest accurate description of the structure of the bones, and Havers was the first to detect the "Haversian canals" named in his honor. See SKELETON.

**HAVERSTRAW**, village, SE New York, in Rockland County, on Haverstraw Bay, the widest part of the Hudson River, and on the New York Central Railroad, 32 miles N of New York City. Haverstraw is situated in the foothills of the beautiful Ramapo Mountains behind the peaks High Tor, Little Tor, and Pyngyp. It was settled by the Dutch about 1648 and its name is derived from the Dutch, descriptive of the waving straw of the river meadows. Here at the Treason House, now torn down, but marked with a tablet, Major André and Benedict Arnold met on Sept. 22, 1780, to plan the betrayal of West Point. In 1825 the short-lived Haverstraw Community was established here. Haverstraw has knitting mills and stone quarries and manufactures bricks, cement, and clothing. Pop. (1950) 5,818.

**HAVIGHURST, WALTER**, 1901–, American author and educator, was born in Appleton, Wis. After studying at Ohio Wesleyan, Columbia, and several other universities, he joined the faculty of Miami University in 1928. His books include *Pier 17* (1935), a novel; *Upper Mississippi: A Wilderness Saga* (1937), one of the "Rivers of America" series; and *The Long Ships Passing* (1942), a Great Lakes history; *Land of Promise* (1946), story of the Northwest.

**HAVRE, LE**, originally called **Le Havre de Grace**, seaport and important commercial and industrial

city, France, in the department of Seine-Inférieure, is situated on the English Channel, at the extreme N of the Seine estuary, 110 miles NW of Paris. Its notable buildings include the 16th-century church of Notre Dame, a museum, a Renaissance town hall, law courts, and an exchange. The fine harbor, one of the best in Europe, contains 14 dock basins, more than 11 miles of quays, and a water area of about 218 acres. There are deep-water wharves, capable of accommodating the largest vessels. The entrance channel, maintained at a 33-foot depth, has a tidal dock. Tancarville Canal leads to a very extensive network of inland waterways. Le Havre ranks second among French ports in the number of vessels entering, and third in the amount of tonnage entered and cleared. The chief imports are coffee, cereals, cotton, wool, coal, petroleum products, metals, and dyewoods. Exports are manufactured products, including fine luxury goods. The principal industries are shipbuilding, foundries and machine shops, chemical and dye works, and sugar refining.

Le Havre was originally the site of a fishing village. Francis I began the construction of the port in 1517 and gave it its name. In 1562 the fortified section of the port was ceded to the English by the Huguenots; it was retaken in 1564. It was shelled by the English in 1694 and 1759, and in the Franco-Prussian War (1870–71) was the scene of stubborn French resistance against the Germans. During World War I it was the seat of the Belgian government in exile. In World War II it became a German base of operations and was heavily bombed by the Allies. Taken by the British on Sept. 12, 1944, the damaged port was sufficiently repaired by October to receive light craft. By the summer of 1946, the harbor was in great part repaired. Pop. (1946) 106,934.

**HAVRE**, city and international airport of entry, N Montana, seat of Hill County, on the Milk River, the Great Northern Railroad, and U.S. Highway 2, about 107 miles NE of Great Falls. It was settled in 1887 and named for the French port. Situated in an agricultural district, Havre has a creamery and railroad shops. Northern Montana College, a unit of the University of Montana, is located here. Pop. (1950) 8,086.

**HAVRE DE GRACE**, city, NE Maryland, Harford County; at the head of Chesapeake Bay and the mouth of the Susquehanna River which is here crossed by two bridges; on the Pennsylvania and the Baltimore and Ohio railroads and U.S. Highway 40, about 35 miles NE of Baltimore in a rolling agricultural region. The site was settled in 1658 as Susquehanna Lower Ferry; the town was incorporated in 1785 and its present name was first used by Lafayette in a letter written that same year to George Washington. During the Revolutionary War Rochambeau's troops camped near by, and in 1813, a British fleet attacked and burned much of the city. Havre de Grace has a nationally known race track, hunting courses, and resort hotels. The ordnance proving grounds and training center of the U.S. Army is located at Aberdeen, six miles southeast. Havre de Grace is a shipping point for coal and lumber and the headquarters for important shad and herring fisheries. Granite quarries and a fish hatchery are near by. The city's chief products are processed seafood, canned fruits and vegetables, beverages, and clothing. Pop. (1950) 7,809.

**HAW RIVER, BATTLE OF**, a Revolutionary War engagement that was fought on Feb. 25, 1781, between American troops under Col. Henry Lee (father of the Confederate general Robert E. Lee) and loyalist militia, about 25 miles west of modern Durham, N.C. Lee planned to capture about 400 loyalists who were en route to reinforce Lt. Col. Banastre Tarleton—then in retreat from Cowpens to join Gen. Charles Cornwallis at Hillsboro—by posing as Tarleton. The loyalists discovered the ruse in time to fight, and were almost annihilated by Lee's forces.

### Harbor at Le Havre before World War II

FRENCH NATL. TOURIST OFFICE





# HAWAII



Niihau  
Kauai

Oahu  
Honolulu  
Molokai  
Lanai  
Kahoolawe  
Maui

Hawaii  
Hilo

HAWAII VISITORS BUREAU

Discovered by Captain Cook in 1778, this palmy paradise in the Pacific Ocean was the first Japanese target in World War II

**HAWAII**, state, extreme W United States, in the N central Pacific Ocean; consisting of all the Hawaiian Islands (formerly known as the Sandwich Islands) except the Midway Islands, and excluding Palmyra Island, which was part of the former Territory of Hawaii; extending 1600 miles in a WNW-ESE direction from Kure Island to the island of Hawaii; 2300 miles WSW of California and 1600 miles S of Alaska (Aleutian Islands); area 6423 sq. mi., including 16 sq. mi. of inland water; pop. (1950) 499,794. Hawaii ranks 47th among the states in area and 45th in population; it was the 50th state to enter the Union. Honolulu is the capital. See map in Atlas, Vol. 20.

## THE ISLANDS

Hawaii's eight main islands, seven of which are inhabited, are all in the east. A number of coral reefs and volcanic islets, some of which appear only at low tide, are largely in the western stretches of the Hawaiian archipelago.

**Hawaii**, somewhat like a triangle in form, is the largest of the islands; area 4,021 sq. mi.; pop. (1950) 68,129. The island is made up of five volcanic mountains about 20 miles apart, which are connected by ridges of joined lava flow from 3,000 to 7,000 feet in height. Hawaii is the youngest of the islands and is still in the process of formation by volcanic action; consequently little of its almost 300 miles of coast is bordered by coral reefs, and there has been only a small amount of erosion, confined principally to the coast northeast of Hilo, the chief town and harbor. On the north side, on the windward slopes of the mountains, heavy rains have cut valleys, which are several thousand feet deep and recede from 1,500-foot coastal cliffs, cut by the waves; the chief of these are the Waipio and the Waimano. The leeward side has relatively little rain.

The oldest mountain is Kohala (5,505 ft.), the north side of which is deeply eroded; higher slopes of the leeward side are covered with cinder cones. Mauna Kea (White Mountain) has glacial markings on its windward slopes. A small lake at 13,000 feet often freezes over, and the cinder cones of the 13,825 foot peak are covered with snow. This is the highest mountain of the Hawaiian Islands, and taking into account that it rises from the ocean floor some 18,000 feet below sea level, it is the tallest mountain in the world. In the western part of the island is Hualalai crater (8,275 ft.) which is covered with cinder cones. Mauna Loa (13,675 ft.) lies to the southeast of Hualalai and has a crater (3.7 sq. mi.). Mauna Loa

has a greater lava flow than any other volcano in the world. Although the crater becomes active preceding an eruption, there has been no recorded lava flow from it; the lava has burst from the sides at an elevation of between 7,000 and 13,000 feet. During the eruption of 1935-36, the flow was bombed from airplanes to divert its course. Kilauea (4,088 ft.), in the southeastern part of the island, has a large, active crater (4.14 sq. mi.). Although an independent volcano, it is a part of Mauna Loa. There are only occasional flows over the floor of the larger pit, most of the action taking place in the inner pit. In 1916 the United States created the HAWAII NATIONAL PARK of Mauna Loa and Kilauea, and in 1927 a strip connecting the two was added.

There have been numerous earthquakes and occasional tidal waves, the latter concentrated on the east coast. One tidal wave in 1868, during a time of lava flow which caused a landslide that killed 31 persons, swept several small villages killing 46 additional persons. At that time the coast subsided some feet. Another damaging tidal wave occurred in 1946, when an earthquake on the ocean floor near the Aleutians built up a speeding wall of water that inundated the northeastern coastal area of the island, reaching the Hilo breakwater, and filling up the 35-foot harbor channel so that only a 20-foot depth was left. There was great property damage and the death toll reached 50 persons.

**Maui** lies to the northeast of Hawaii; area 728 sq. mi.; pop. (1950) 40,084. Together with Molokai, Lanai, Kahoolawe, and the uninhabited Molokini, Maui was probably once a single island; but now the islands are separated by channels from 6 to 10 miles wide and 250 to 600 feet deep. Alenuihaha Channel, separating them from Hawaii, is 23 miles wide and 2,244 feet deep. A part of the Hawaii National Park is here. Maui has two mountains which are connected by the low isthmus only six miles wide. Haleakala (10,032 ft.), in the eastern part of the island, has the largest extinct crater in the world, measuring 20 miles around and some 2,700 feet in depth. Its 16 red-colored cinder cones range from 400 to 900 feet high. The rainy side has many gorges which are rich in waterfalls and green growth and along which a scenic drive has been built. The eastern peak, Puu Kukui (5,790 ft.), is much older and has deep radiating canyons of great beauty.

**Kahoolawe** is a single mountain (1,477 ft.), protected on the north by Maui; area 45 sq. mi.; pop. (1950) none. There is no forest on the island.

**Lanai**, too, is a single mountain obtruding from the sea to 3,370 feet; area 141 sq. mi.; pop. (1950) 3,137. Cliffs on its southern coast are exposed to the ocean; the northern coast is in the lee of Molokai and Maui. A pineapple company controlling the whole of the island has built a harbor and constructed a modern town, Lanai City, on the extensive interior plateau, which is entirely planted.

**Oahu**, the most developed of the islands, has the largest population; area 589 sq. mi.; pop. (1950) 353,020. The island consists of two parallel mountain ranges, the result of the erosion of two large volcanoes. The Koolau range extends along the northeast shore, rising at its eastern end in Konahuanui, (3,105 ft.). It is older and almost twice as long as Waianae, the range along the southwestern shore. Waianae reaches 4,050 feet in Kaala, in the north central part of the range. Both ranges are extremely rugged; their outer sides are precipices rising from the sea or from the lower lands, which nowhere extend inland more than

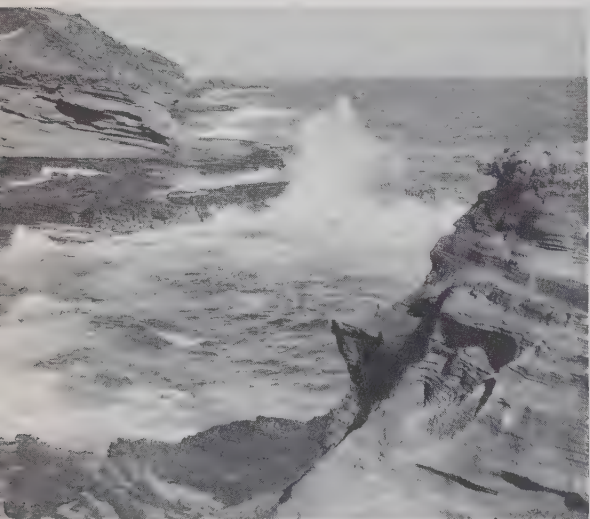
3,000 ft. deep); area 72 sq. mi.; pop. (1950) 219. Its eastern third is tableland with Paniau reaching 1,281 feet. The rest of the island is of coral origin. The island is privately owned and is devoted to the raising of sheep.

**Lehua** and **Kaula** are uninhabited and are protected bird refuges. Lehua lies one-half mile north of Niihau; Kaula, 23 miles southwest of Niikahu.

**Molokai** lies between Oahu and Maui; area 261 sq. mi.; pop. (1950) 5,286. The island is mountainous (Mount Kamakou reaches 4,958 ft. above sea level) and a road joins the towns on its south shore. There is a famous leper settlement at KALAWAO, on the north shore, founded by Father DAMIEN.

**Climate.** Although all the inhabited Hawaiian Islands lie south of the Tropic of Cancer, they have an equable climate unusual in the latitude. There is much sunshine, and the islands are free from destructive tropical storms. The coolness of the islands is due to the northeast trade winds which prevail for some nine months of the year, to the cool ocean currents flowing from the Aleutian Islands, and to the heights and contours of the land. During the winter months the kona, a southerly wind, brings some mugginess and heavy rains. The rainy slopes are cooler than the leeward, and the temperature diminishes an average of 1° for each 300 feet of height. The rainfall varies rather largely, Honolulu's average being only 28.60 inches, with an average temperature of 74.6° F. Snow usually stays the year round on Mauna Kea and Mauna Loa and remains at times on Haleakala.

**Plants and Animals.** The plants of the islands show great variety and extent. There are more than 900 species of plants, of which some 300 are trees. Of the 140 varieties of ferns, some are as small as a dime and others tower to 35 feet. There is a species of violet with a woody stem that mounts to six feet. However, the islands are poor in native palms, and above 11,000 feet there is no vegetation. The islands may be divided into six botanical regions: the strands, the lowlands, the lower forest, the middle forest, the mountain bog, and the upper forest. Hundreds of plants have been introduced into the islands; some of the more ancient importations (brought by the Polynesians) are: coconut, mountain apple, taro, yam, banana; and sugar cane. Notable among recent plant importations are: avocado, mango, pineapple (which has become the islands' second industry), citrus fruits,



HAWAII VISITORS BUREAU

#### Rocky coast of Koko Head crater on Oahu Island

seven miles from the sea. Some elevated coral formation gives evidence of earlier great subsidences. From its northern meeting with the sea to Pearl Harbor, Oahu is roughly square, but the Koolau range extends beyond the square in a southeastern projection which holds Honolulu, the state's largest city and trade center. Honolulu is the terminus of the railway extending past Waipahu, at Pearl Harbor, along the southwestern shore to the base of Kaena Point, then east along the northern coast, and finally south to Kahana on the northwestern coast. Pearl Harbor is a great naval base (10 sq. mi.) which the Japanese attacked in World War II. Pali, six miles up a beautiful valley behind Honolulu, is the only traversable pass (1,207 ft.) to the east coast through the Koolau range. See PEARL HARBOR.

**Kauai** is separated from Oahu to the south and east by the Kauai Channel (63 mi. wide and 11,232 ft. deep) and is roughly oval in shape; area 551 sq. mi.; pop. (1950) 29,631. There is one mountain with three peaks: Kawaikini (5,170 ft.), Waialeale (5,080 ft.), and Namolokama (4,409 ft.). There are marginal lowlands on all but the northwest coast. Kauai is the oldest and most verdant of the larger islands and has many rivers and waterfalls. Grand Canyon of the Waimea (3,000 ft. deep), in the southwest, is not unlike the Grand Canyon of the Colorado River. The Napali precipices on the northwest coast reach 4,000 feet.

**Niihau** is separated from the western shore of Kauai by the Kaulakahi Channel (15 mi. wide and



HAWAII VISITORS BUREAU

#### Giant tree ferns grow in Hawaii National Park

papaya, guava, coffee, grape, fig, gooseberry, litchi, mulberry, and date.

There is only one certain indigenous land animal,





**Hibiscus**, Hawaii's national flower, is as much a part of Hawaii as are the sand, sunshine, and blue sparkling waters. Here it frames a view of a suburb of Hilo



**Students** of many diverse races living together at Maryknoll School in Honolulu don colorful costumes to participate in one of the national celebrations



**Fishing Boats**, part of the great fleet which supports the important fishing industry of the islands, ride at anchor in Kewalo Basin, Honolulu



**Waikiki Beach**, with its outrigger canoes, surfboard riding, and colorful beach, is the symbol of Hawaii to vacation-minded people the world over



**Punahou**, founded in the 19th century, is the oldest college preparatory school west of the Rockies. Baldwin Hall can be seen under the poinciana and palm trees





Kauai Island is well named the "garden island," for its tropical beauty awes and delights. It is noted for white beaches, deep rivers, and sheer impassable cliffs



The Sugar Mill at Kekaha typifies the vast sugar industry which is of first importance in Hawaii. Sugar cane covers the lowlands of Kauai



Chinese Teen-Agers of Honolulu who ordinarily dress like their school contemporaries appear in ancestral costumes for a holiday celebration. There are many

old pioneer families who cling to their homeland customs so that at festivities there is a colorful blending of ancient and modern customs





HAWAII VISITORS BUREAU

Beautiful panorama seen from Nuuanu Pali cliff



EWING GALLOWAY

Air view of Kilauea Crater on Island of Hawaii



HAWAII VISITORS BUREAU

Hawaiians practice lauhala weaving, a Polynesian craft



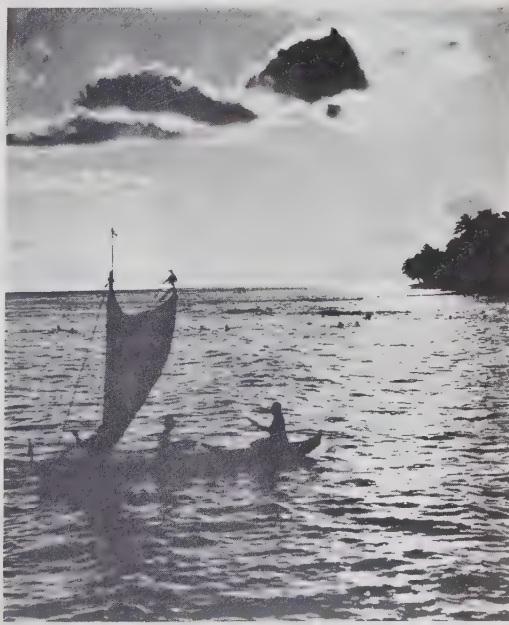
HAWAII VISITORS BUREAU

Native Vendors, displaying colorful flower leis, greet the tourists who arrive in Hawaii from the many steamers serving the islands



HAWAII VISITORS BUREAU

Fishing with a throw net is a Hawaiian art



Moonlight sailing is one of delights of Hawaii



a small bat. Chickens, dogs, hogs, rats, and mice were anciently introduced by the Hawaiians. Since Cook's discovery of the islands a number of domestic animals have been brought in, including goats and English pigs (1788), cattle and sheep (1793), and horses (1803); spotted deer were introduced in 1867, and mongooses were imported in 1883 to destroy the increasing rats. There are about 125 species of birds, both resident and migrant; among them are some 60 songbirds peculiar to Hawaii. The reptiles are small skinks and geckos, or lizards. There are no snakes, but frogs and toads have been introduced. The marine life includes some 650 species of fish, many of which are extraordinary in shape and coloring. Trout, carp, black bass, catfish, gold fish, and top minnows have been planted in Hawaiian streams.

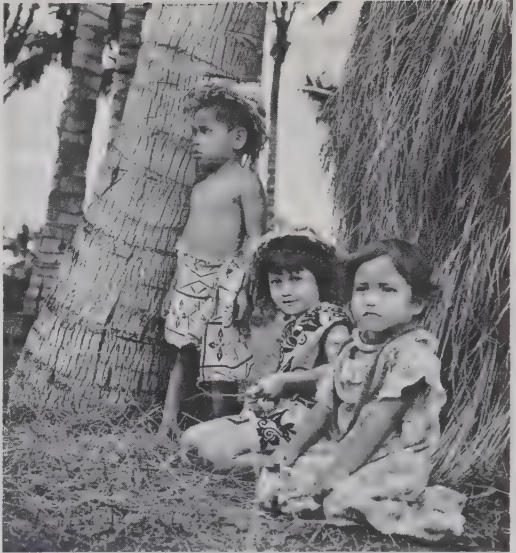
PEOPLE

**Population.** Captain Cook, upon discovery of the islands in 1778, estimated that there were between 300,000 and 400,000 Hawaiians; probably the smaller figure is nearer to fact. The native Hawaiian is Polynesian; the date and route of his arrival is uncertain, but it is probable that the first arrivals came from the SOCIETY ISLANDS. Since Cook's discovery, the island population has lost its extreme homogeneity because of the decrease of native Hawaiians in the century that followed, the large increase of immigrants, and intermarriage with the immigrants. The native Hawaiian may eventually disappear through intermarriage. Missionaries estimated in 1823 that the native population was 142,050, and the first census (1832) disclosed only 130,313, of whom a few were foreigners. A census in 1872 indicated a total population of only 56,897, of whom 5,300 were foreigners. Immigration increased after the signing of a reciprocity treaty with the United States, so that the 1878 census revealed a population of 57,985, of whom the Hawaiians and part-Hawaiians constituted 81.9 per cent. The census of 1900, taken after Hawaii became a Territory, showed a population of 154,001, of which only 24.4 per cent (37,656) were Hawaiians and part-Hawaiians. The remainder included 28,819 Caucasians, 5,767 Chinese, and 61,111 Japanese. The 1940 census showed a total population of 423,330, of whom 64,310 were Hawaiians or part-Hawaiians (15.2 per cent), but the fullblooded Hawaiians had decreased to only 14,375. The population of the Hawaiian Islands grew rapidly after they became a United States Territory, the largest growth occurring in the 10 years ending in 1930.

| PRINCIPAL CITIES | POPULATION  |             |
|------------------|-------------|-------------|
|                  | Census 1940 | Census 1950 |
| Honolulu.....    | 179,326     | 248,034     |
| Hilo.....        | 23,353      | 27,198      |
| Wahiawa.....     | 5,420       | 8,369       |
| Wailuku.....     | 7,319       | 7,424       |
| Waipahu.....     | 6,906       | 7,169       |
| Lahaina.....     | 5,217       | 4,025       |

Immigration to the islands was encouraged by the native rulers, and over the years between 1859 and 1914 Polynesians (who as immigrants proved failures and were returned to their native islands), Americans, Norwegians, Galicians, Russians, Poles, Portuguese, Spanish, Italians, Puerto Ricans, Japanese, Koreans, and Filipinos, were encouraged to come to the islands. The Japanese, Portuguese, Koreans, and Filipinos have brought their families with them and have proved good laborers. Most of the other nationalities soon outgrew work as laborers and found other occupations, or departed from the islands. During the period of World War II the population was greatly increased by the importation of workers for the defense installations of the islands.

The 1940 census revealed that there were more Japanese in the Hawaiian Islands (157,905) than any other group of people, including the original inhabitants. During World War II, these enemy-



HAWAII VISITORS BUREAU

Children wear three types of Hawaiian costume

born or enemy-descended people furnished a full share to the fighting forces of the United States, the greater part of them fighting in the Italian campaigns to such effect that they were honored by a number of unit and individual citations. For the greater part of the war period the islands were placed under military control, and the right of habeas corpus was suspended. Yet at no time was it thought necessary to build detention camps for the Japanese, as was done on the United States mainland. See PEOPLES OF THE WORLD; POLYNESIA.

**Education.** The Hawaiians readily accepted education, and only 12 years after the arrival of missionaries in 1820, there were some 900 schools teaching 53,000 island people. In 1824 the regent and chiefs prescribed compulsory education, and the students of that day were 40 per cent adults. By 1832 fully 80 per cent of the native Hawaiians were literate. In 1831 and 1834 two institutes were founded for the training of teachers and religious assistants, with the courses dealing largely in normal and industrial training techniques. Education had progressed to such an extent in the 1830's and 1840's that students were attracted from Spanish California, Kamchatka, and other Pacific islands to the English-taught school in Honolulu. The present school system embraces classes from the kindergarten through the university, with normal schools and special schools for the teaching of the physically handicapped, the feeble-minded, and juvenile delinquents. A system of evening classes for adults has been instituted. The University of Hawaii has about 6,000 students. The school system is under territorial control, but the buildings and physical equipment are controlled by the local communities. In 1953-54 there were 192 public schools with 106,464 students and 114 private schools with 25,897 students; the appropriation for public instruction was \$18,759,348. School attendance is compulsory between the ages of 6 and 14. Each of the four counties has a public library, and there are many branches throughout the islands.

**Religion.** The first American missionaries arrived in the islands in 1820 and the conversion of the people to Christianity quickly followed. Most of the people are Christians but there are several sects of Buddhism. The Mormons also have a large following. Most of the major American denominations and communions are represented in the islands.

**Public Health** in the Hawaiian Islands has been second only to education in importance. Physicians



are employed or subsidized for the benefit of all. The Board of Health is older than that of Massachusetts (1869), the first state to establish one. In 1953-54 the Public Welfare Department spent \$5,425,610 (not including administrative costs), of which the federal government contributed 52 per cent. In 1953 there were 34 registered nonmilitary hospitals.

#### ECONOMIC LIFE

**Industries.** Sandalwood was the first commercial product of the Hawaiian Islands. The first demand came from the fur traders in 1800 and proved so profitable that the native kings and chiefs put most of their people to work cutting and processing the wood. By 1840 the supply of sandalwood had been exhausted. Between 1820 and 1880 whalers called twice a year at the islands for rest, repairs, supplies, storage, and the transfer of oil and whalebone. Many Hawaiians were engaged as seamen, and in 1846 there were some 3,000 Hawaiian young men aboard the whaling ships. Between 1840-60, the height of the whalers' visits, some 400 ships put into Hawaiian harbors each year. There was also local whaling activity. The discovery of petroleum and, later, the American Civil War lessened the importance of whaling.

Only small quantities of SUGAR were produced between 1802-35, but after 1835 there was some expansion in the cultivation of sugar cane. In 1876 there were 13,036 tons of sugar produced. In that year a reciprocity treaty with the United States was signed, and sugar production mounted rapidly. In the year of annexation of the islands to the United States, 1898, the sugar production was 229,414 tons. The islands then increased their production steadily until 1933, when 1,035,548 tons were processed. Following 1933, sugar was put on quota, and its production in 1940 dropped to 938,037 tons. In 1953 Hawaii produced 1,099,316 tons. The average yield per acre of sugar cane in Hawaii is seven and a quarter tons of sugar, the highest in the world, and extremely fertile soil has produced as much as 18 tons. The growing season for the cane is from 14 to 24 months. Many of the modern processes in the production and processing of sugar have been developed in Hawaii, including centrifugal drying, invented in 1851. The control of sugar production, from planting through processing to sale, is in the hands of a few corporations. Most of the unskilled laborers are engaged under contracts which provide living quarters, gardens, medical attention, and other services. Hawaii has had a number of serious strikes among workers in the sugar industry (1909, 1920, and 1950). After World War II unionization grew rapidly.

Second in importance to sugar as an industry is the PINEAPPLE, which is not indigenous to the islands. Since it was not common in world markets, the growers and canners needed to develop the sale as they increased production. In 1903 Hawaii produced 1,893 cases of pineapples, and in 1955, 29,243,536 cases of canned fruit and juice.

Before the advent of the pineapple, Hawaii had produced livestock, coffee, and rice, which ranked after sugar in the order listed through the years. There are numerous ranches and dairies on the islands, many of which raise thoroughbred stock. "Kona" coffee, so-called from the district on western Hawaii Island in which it is grown, is of superior quality. The production of rice has declined. Other products include bananas, silk, cotton, tobacco, rubber, vanilla, sisal, potatoes, wheat, flour, and the macadamia nut.

The mineral wealth is limited, but building stone, lime, and salt are produced.

It was early recognized that the Hawaiian future lay in agricultural production. Since 1850 there has been an effort to bring in homesteaders, although the first efforts met with little success. Since 1920 the government has undertaken the policy of making

permanent improvements in the land, or carefully selecting settlers, and offering long-term loans.

The manufacturing industries owe their being to the agricultural needs and are principally the processing and production of iron, fertilizers, cans, and sugar processing machinery. Manufactures of poi, biscuits, macaroni, starch, soft drinks, confectionery, shoes, clothing, furniture, musical instruments, pipe and tile, lime, and boats are of local importance.

In more recent years, except when interrupted by World War II, the tourist business was third in importance. In 1921 some 8,000 tourists visited the islands; in 1940 this number had grown to 25,000. In 1955 some 105,000 visitors spent approximately \$49 million in the islands. Many hotels, boarding houses, and recreational areas have been built to take care of the people who come to Hawaii to enjoy its scenic wonders and its climate.

**Commerce and Communications.** Imports for the fiscal year 1952 from mainland United States, which handles 98 per cent of Hawaii's trade, amounted to \$349 million, and exports to the mainland were valued at \$250 million.

#### EXPORTS TO MAINLAND UNITED STATES, 1947

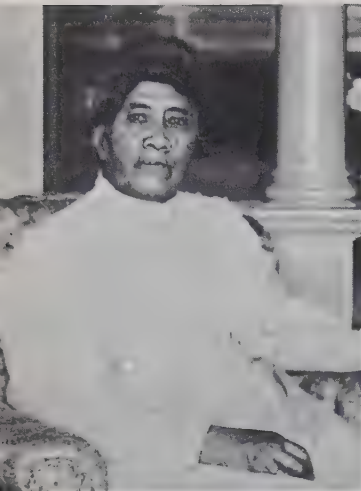
|                             |              |
|-----------------------------|--------------|
| Sugar.....                  | \$93,815,000 |
| Molasses.....               | 4,800,000    |
| Fruits and juices.....      | 51,168,000   |
| Fiber insulating board..... | 1,607,000    |
| Coffee.....                 | 1,531,000    |

Honolulu's modern docks and wharves in 1953-54 accommodated 1,068 ocean vessels, exclusive of military ships and the interisland craft, with a gross tonnage of 2,410,503. A navigation company and seven airlines provide communication among the islands. Regular plane service was instituted in 1936 between the islands and the American and Asiatic mainlands; several airlines now connect Hawaii with mainland United States, Canada, Australia, and the Far East. There are only a few miles of railway line, and some 2,300 miles of paved highways in the islands. In 1953 there were 138,357 motor vehicles registered.

The railways, telephones, telegraph, and radio are under the Interstate Commerce Commission; other utilities are under the control of the Territorial Public Utilities Commission. There is a unified telephone and radio system for the five largest islands, and about 10 commercial radio stations.

#### GOVERNMENT

The 1950 state constitution provides for a senate of 25 members, elected from six senatorial districts for terms of four years; and a house of representatives of 51 members elected from districts within four basic representative areas for terms of two years. The house of representatives must be reappointed every 10 years according to the number of voters in each representative district at the last general election. The constitution provides for the concurrent election of a governor and a lieutenant governor to four-year terms, and for the creation by the legislature of other executive and administrative departments within three years after the admission of Hawaii to the Union. The governor's power of veto extends to all legislation including items of appropriation bills, and may be overridden by a two-thirds vote of each house of the legislature. The judicial system consists of a five-member supreme court and circuit courts; and the legislature has authority to create other courts. All judges are appointed by the governor with the advice and consent of the senate. The legislature is authorized to create counties and other units of local government. The principal requirements for registration to vote are the minimum age of 20 years, residence in the state for one year immediately preceding the election, and the ability to speak, read, and write either English or Hawaiian. Hawaii is represented in the U.S. Congress by two senators and one representative.



EWING GALLOWAY

**Queen Liliuokalani**, above, was deposed in 1893. Her home, right, is now residence of the U.S. governor



NEWS OF HAWAII



UNDERWOOD & UNDERWOOD

**These Hawaiian Natives** wear costumes similar to those worn in Hawaii at the time of its discovery



ACME

**King Kalakaua and his party** as they appeared on visit to the United States in 1875 (from old print)

**Explosion of U.S.S. "Shaw" at Pearl Harbor during the Japanese attack of December 7, 1941**

WIDE WORLD





## HISTORY

Hawaii is said to have been visited by white men as early as 1527, but its discovery is generally attributed to CAPTAIN JAMES COOK, who explored the Islands in 1778, named them the Sandwich Islands, after the Earl of Sandwich, and lost his life in an altercation with the native inhabitants in 1779. At the time of their discovery the islands were densely populated by a semicivilized people living under a feudal governmental system with a king upon every island. In 1790, however, Kamehameha, king of the island of Hawaii, with the aid of firearms obtained from American whalers, united the whole group under his control, and established a kingdom which lasted until 1894. Upon his death in 1819, Kamehameha was succeeded by Liholiho, who adopted on his accession the name of Kamehameha II and whose reign was famous for the abolition of idolatry simultaneously throughout all the islands. Christianity was introduced by missionaries from America in 1820. The Ten Commandments were adopted as a basis of laws in 1825; in 1840 Kamehameha III issued a constitution granting civil rights to the people, and in 1852 universal suffrage was proclaimed and a legislature was formed.

**Kamehameha IV**, 1854–63, succeeded Kamehameha III and was in turn succeeded by his brother Kamehameha V, who abrogated the constitution and imposed a property qualification on the voters. With his death in 1873 the line of the Kamehamehas became extinct, a high chief, Lunalilo, was elected to the vacant throne, and in 1874 was succeeded by another high chief, Kalakaua. The weakness of these kings led to a period of regencies by women—Kaahumanu, Kinau, and Kekaulohi, who were deserving of great praise as rulers. The reactionary reign of Kalakaua (1874–91), his efforts to restore the ancient order and religion, and the unsatisfactory state of the public finances, demanded some measure of reform, and in 1887 the king was called upon to dismiss his cabinet and to grant a more popular constitution. His successor, Queen LILIUOKALANI, however, evaded the terms of the new constitution, and leading citizens, mainly Americans, rose in rebellion, in January, 1893, deposed the queen, and applied for the annexation of Hawaii to the United States. A treaty providing for annexation was submitted to the Senate by President Harrison, but it was withdrawn by President Cleveland immediately upon his accession. A commissioner was sent to examine the situation, and upon his report the United States government evinced a readiness to acquiesce in the restoration of the queen to her throne; Liliuokalani refused, however, to grant an amnesty to the revolutionists; a provisional government was accordingly formed, and on July 4, 1894, a republic was proclaimed with SANFORD D. DOLE as president. Sentiment for annexation continued to grow, however.

**Annexation.** In 1895 the queen was forced formally to abdicate her throne, and on Aug. 12, 1898, the islands were annexed to the United States. On June 14, 1900, they were organized as a Territory. In 1910 certain amendments to the organic act were passed by Congress including measures for the administration of public lands. In 1912 important improvements were completed at Pearl Harbor, and in 1916 Hawaii National Park was established. In 1924 the Territory was entitled by Act of Congress to share in the Shephard-Towner Maternity Act, the Vocational Education Act, the Vocational Rehabilitation Act, the Federal Farm Loan Act, and the Federal Highway Act. In 1928, the 150th anniversary of Captain Cook's discovery of the islands was celebrated with fitting ceremonies. Tension between naval and military personnel and civilians came to a climax in 1931 and as a result a report on crime and law enforcement in Hawaii was presented to the United States Senate in 1932.

**World War II and Statehood.** At Pearl Harbor the blow was struck that brought the United States into World War II as a belligerent on Dec. 7, 1941 (see PEARL HARBOR). The islands became a principal staging area for the Pacific forces in the counter-offensive against Japan. Martial law was put into effect in the islands and military restrictions were stringently enforced. In August 1943 the suspension of habeas corpus by the army was challenged by U.S. District Court Judge Delbert E. Metzger, who was supported by the U.S. Supreme Court, but only after the war. See HABEAS CORPUS.

The war brought great industrial and port development to the islands. After the war the development of the labor movement, especially among plantation and dock workers, was marked by a 176-day strike by longshoremen in 1949. The movement for admission of Hawaii to statehood, which began early in the twentieth century, became stronger after the war. In 1950 the territorial legislature drafted a provisional state constitution, which was ratified by popular vote on November 7 of that year. Congressional opposition to Hawaiian statehood, caused partly by fear of alleged Communist influence in Hawaiian labor circles and partly by prejudice against the large nonwhite population in Hawaii, substantially diminished after passage of the separate Alaskan statehood bill in 1958. In early 1959 a bill to admit Hawaii as the 50th state was introduced in the 85th Congress; it was approved by the Senate on March 11 and by the House of Representatives on March 12, and was signed by President Eisenhower on March 19.

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**HAWAII NATIONAL PARK**, located on the islands of Hawaii and Maui in the Hawaiian Islands; total acreage 246,747.62. The park contains the active volcanoes Mauna Loa and Kilauea on Hawaii and the dormant volcano Haleakala on Maui. Mauna Loa was active in 1940 when a 4-mile rift opened in the side of the volcano. The park contains unusual scenic splendors and a wide range of the varied Hawaiian plants. It was constituted in 1916, and there have been five additions to its acreage since, the latest in 1940.

**HAWARDEN**, market town and parish, N Wales, Flintshire, overlooking the Dee valley; 6 miles SW of Chester, England. Hawarden has the ruins of a thirteenth century castle to the northeast of which stands Hawarden Castle, the residence of Gladstone from 1874 to 1898. Pop. about 9,000.

**HAWES, STEPHEN**, d. ?1523, English poet. His chief works include the allegory *The Passetyme of Pleasure* (1509) and a number of minor poems.

**HAWFINCH**, a large finch of the grosbeak group, abundant in southern Europe and throughout the greater part of England. The adult male has the crown and back chestnut brown, the neck and breast pale brown, the neck crossed at the back by a broad band of ash color, wings partly black, greater wing coverts black or blackish brown. The hawfinch, *Coccothraustes coccothraustes*, is extremely shy.

**HAWICK**, burgh, SW Scotland, Roxburghshire, situated on the Teviot River at its junction with the Slitrig; 53 miles SE of Edinburgh. In the vicinity is Branxholm Castle, an old stronghold of the Scotts of Buccleuch and the scene of Sir Walter Scott's *Lay of the Last Minstrel*. The town has long been noted for its manufactures of woollen goods. It also has a dye-works. Pop. (1950 est.) 17,650.

**HAWK**, a term usually applied to diurnal birds of prey that are not vultures or eagles. Hawks comprise the family *Accipitridae* which includes the largest number of forms in the order *Falconiformes*. They are usually birds of medium to large size with broad wings, strong legs, feet armed with sharp claws, and strongly hooked bills. Many have rapid flight, but others are slower fliers. Soaring in great circles high above the earth is common flight behavior among hawks. Belief in the destructive habits of hawks is almost universal, but distinction must be made between those species like the Cooper's hawk and the GOSHAWK that are sometimes destructive to game, and the red-tailed hawk and many others that are beneficial to man because they are destructive to rodents.



J. W. JACKSON

### Rough-legged hawk

The group as a whole is beneficial to man because of the relatively few species that prey on other birds and game. See BROAD-WINGED HAWK; BUZZARD; FALCON; SPARROW HAWK.

**BIBLIOG.**—J. B. May, *The Hawks of North America: Their field identification and feeding habits* (1935); A. C. Bent, *Life Histories of North American Birds of Prey*, Parts 1 and 2, U. S. Nat'l Mus. Bull. 167 and 170 (1937, 1938).

**HAWK MOTH**, also called **Sphinx Moth**, a stout-bodied moth with strong wings and hooked antennae. These small or medium-sized moths constitute the family *Sphingidae* and have long, coiled sucking tubes on the lower part of the head. Their coloration is beautiful but subdued, usually combining shades such as black and yellow, olive and tan, ochre and brown. The larva is equipped with a horn on the eighth abdominal segment; when resting, it raises the front half of its body, this part being almost perpendicular to the remainder of the body. Among the better known hawk moths of America are the modest sphinx, *Pachysphinx modesta*; the white-lined sphinx, *Celerio lineata*; the twin-spotted sphinx, *Smerinthus geminatus*; and the pandorus sphinx, *Pholus pandorus*. The larvae of *Protoparce quinquemaculata*, known as the tomato hornworm, and that of *P. sexta*, the tobacco hornworm, feed on the leaves of tomato, potato, and tobacco plants.

**HAWKBIT**, a name applied to the members of the genus *Leontodon*. The autumnal hawkbit (*L. autumnale*), or fall dandelion, is the only species naturalized in the United States. It has a tuft of pinnatifid root leaves, branched scape, and large flower heads with long, yellow, petal-like florets. It resembles the dandelion closely in appearance, but blooms later. The name "hawkbit" is also applied to several species of *Hieracium* (see HAWKWEED).

**HAWKE, EDWARD, BARON**, 1705–81, English admiral, was born in London. He joined the navy in 1720, and first distinguished himself in the action off Toulon in 1744. In 1747 he gained a victory over the French off Finisterre; in 1757 he was made full admiral, and in the same year he commanded an expedition to Basque Roads. His great feat—one of the greatest ever performed by a British admiral—came in 1759, when during a fresh gale he destroyed the French fleet under M. de Conflans, in Quiberon Bay. In 1765 he was vice-admiral of Great Britain, and in 1766 he was appointed first lord of the admiralty, a position which he held until 1771. He was created baron in 1776.

**HAWKER, ROBERT STEPHEN**, 1803–75, English poet, was born in Stoke Damerel, Plymouth, and was educated at Oxford. In 1834 he was appointed vicar of Morwenstow, a small village on the Cornish coast, where he lived to the end of his life. He is remembered for his antiquarian studies, such as *Footprints of Former Men in Far Cornwall* (1870), and for the spirited ballad "And Shall Trelawney Die," based on an old Cornish refrain.

**HAWKERS.** See PEDDLER.

**HAWKE'S BAY PROVINCIAL DISTRICT.** See NEW ZEALAND.

**HAWKESBURY**, town, Canada, in the province of Ontario, Prescott County, is situated on the Ottawa River and the Canadian National Railway; 65 miles W of Montreal. The town was incorporated as a village in 1859 and named for a British official, Baron Hawkesbury. It has manufactures of paper, lumber, sashes and doors, gloves and dresses. Pop. (1949 est.) 6,578.

**HAWKESBURY RIVER**, Australia, of New South Wales, rises in the Cullarin Range and under the names of Wollondilly and Nepean flows NW, then turns as the Hawkesbury SE, and enters the Pacific at Broken Bay, about 20 miles NE of Sydney. It has a total length of 330 miles.

**HAWKESWORTH, JOHN**, c. 1715–73, English writer, was born in London. As editor of *The Adventurer* (1752–54), he published the work of Samuel Johnson and other notables. He wrote and adapted plays, and edited the works of Swift.

**HAWKEYE STATE**, a popular name for IOWA. The name was suggested by James G. Edwards, editor, in an early editorial in the Fort Madison *Patriot* some time before Iowa became a state in 1846.

**HAWKING.** See FALCONRY.

**HAWKINS, ANTHONY HOPE.** See HOPE, ANTHONY.

**HAWKINS, Sir JOHN.** See HAWKYNS.

**HAWKINS, Sir RICHARD.** See HAWKYNS.

**HAWKINS, FORT**, military and trading post constructed in 1806 near the Ocmulgee River on the site of the present-day Macon, Ga. In 1812 and 1813 it was the assembling point for troops in the campaign against the Creeks. The fort was abandoned soon after ANDREW JACKSON's victory over the Indians in 1813. On the site is a replica of the old blockhouse, constructed in 1938 by the Daughters of the American Revolution.

**HAWK'S-BEARD**, the popular name of plants belonging to the genus *Crepis* of the composite family. Distinguishing features are the strap-shaped yellow or orange-colored florets, double involucre, and downlike pappus. Several species are adventive from Europe, especially on ballast; the native American species are all western.

**HAWKSBILL**, or **CARET**, a large sea turtle with a strong falcon-like beak, the plates of whose shell supply the TORTOISE SHELL of commerce. It is found in all tropical and subtropical seas.

**HAWKSMOOR, NICHOLAS**, 1661–1736, English architect, was born in Nottinghamshire. From 1679 to 1709 he was in the service of Sir CHRISTOPHER WREN and aided him in building St. PAUL'S CATHEDRAL and parts of Queen's College, OXFORD UNI-



VERSITY. In 1709 he entered the service of the dramatist-architect Sir JOHN VANBRUGH and collaborated in building Castle Howard and Blenheim Palace. Hawksmoor spent his remaining years (1715-1736) on his work.

**HAWKWEED**, or **HIERACIUM**, is a genus of composite plants, characterized by yellow, orange, or red flowers, with imbricated involucre, furrowed and toothed fruit, and bristly pappus. In America, the native species of *Hieracium* are generally known as rattlesnake weeds, but *H. aurantiacum*, which is supposed to be naturalized from Europe, is known as the orange hawkweed. It is a pest in meadows and pastures, especially in New York state, and can only be overcome by cultivation and by preventing the maturing of the flying fruits. The plant is very hairy, with a basal tuft of spatulate or oblong leaves, and large soft flowers of a deep orange color.

**HAWKWOOD**, Sir **JOHN DE**, known in Italy as **Giovanni L'Acuto**, d. 1394, English soldier, was born in Hedingham Sible, Essex, fought under the Black Prince, and from 1363 onward in the Italian wars, for Pisa against Florence, for the Visconti against Pope Gregory XI, and for the Pope against the Visconti, until finally he was secured as captain of mercenaries by Florence.

**HAWKYNS**, or **HAWKINS**, Sir **JOHN**, 1532-95, English seaman, was born in Plymouth, and in 1562 engaged in the slave traffic, being the first Englishman to do so. Aided by the profits of smuggling, and of raids upon Spanish shipping, he was able to conduct two more voyages to the West Indies, one in 1564, and another, with Drake, in 1567. In the latter he was attacked by the Spanish authorities at San Juan de Ulloa, and succeeded in saving only two of his ships. In 1572 he entered Parliament for Plymouth. In 1588 he was given a command against the ARMADA. In 1595 he sailed with Drake to command an expedition to the West Indies, and died on the voyage.

**HAWKYNS**, or **HAWKINS**, Sir **RICHARD**, c. 1562-1622, English naval commander, son of Sir JOHN HAWKYNS, served under Drake on an expedition to the West Indies (1585-86) and against the Armada (1588). He sailed from Plymouth on the *Dainty* (1593), passed through Magellan Strait, surprised and plundered Valparaiso (April, 1594), but was defeated and severely wounded at San Mateo, and carried prisoner to Spain. Released in 1602, he was knighted (1603) and entered Parliament (1604). See **DRAKE**, FRANCIS.

**HAWLEY-SMOOT TARIFF ACT**. See **TARIFF**.

**HAWORTH**, Sir **WALTER NORMAN**, 1883-1950, British chemist, was born in Chorley, Lancashire, and studied at the universities of Manchester and Göttingen. He was a reader in chemistry at the University of St. Andrews (1912-20) and professor of organic chemistry at the University of Durham (1920-25). After 1925 he was director of the chemistry department of the University of Birmingham.

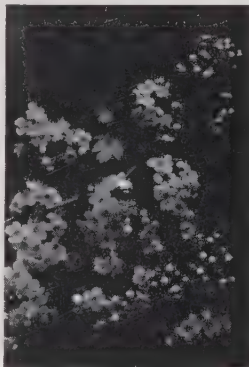
Haworth's earliest research pertained to the structure of terpenes and resulted in the synthesis of sylvestrene (1912). In 1915 he began his investigations of carbohydrates and polysaccharides which enabled him to determine the atomic structure of grape, cane, and milk sugar, as well as of maltose, starch, cellulose, and glycogen. He also determined the chemical constitution of Vitamin C and gave the name ascorbic acid to the synthetic product which he identified with his vitamin (1933).

Haworth wrote *The Constitution of Sugars* (1929). He shared the 1937 Nobel prize in chemistry with PAUL KARRER, and was president of the British Chemical Society (1944-46). He was knighted in 1947 for chemical research leading to the release of atomic energy. See **VITAMIN**.

**HAWORTH**, urban district, England, Yorkshire, in the West Riding, four miles S of Keighley. It has a Brontë museum in the parsonage where the Rev. Patrick Brontë and his daughters Charlotte, Emily,

and Anne lived. Their burial place is here in St. Michael's Church. Pop. about 6,000.

**HAWTHORN**, a genus of thorny shrubs and small trees belonging to the family *Rosaceae*. These plants have simple leaves and corymbs of pink or white flowers that develop into small red or yellow pomes. Hawthorns, *Crataegus*, generally distributed throughout the United States, are often associated with the succession of shrubby flora growing in cutover fields and pastures. They are extremely difficult to classify because of the great intergradation among species. A few hawthorns are grown as ornamentals, and the fruit of the red haw, *C. mollis*, is often used in the preparation of jams and jellies. Hawthorn wood is extremely strong and hard and is used to make tools and other small articles where strength and toughness are required. Hawthorns, used as hedgerows in England since the Roman occupation, are still used to a limited extent in both England and the United States. The flowering branches were traditionally used in May Day celebrations in England. According to a legend, popular in Britain, one species, the Glaston-



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Hawthorn blossoms, left, and fruit, right

bury thorn, which is said to have bloomed on Christmas day, was used as a staff by Joseph of Arimathea.

**HAWTHORNE**, **NATHANIEL**, 1804-64, American writer, was descended from an old New England family which had been in Massachusetts since 1630. He was born in Salem, Mass. After the death of his father, a sea captain, he, his sisters, and his mother continued to live in Salem, though there were frequent visits to his uncle's farm in Raymond, Me. He attended school in Salem and there prepared for college under the direction of a tutor.

Between 1821 and 1825, he attended Bowdoin College, where he became acquainted with several lifelong friends. These included Henry Wadsworth Longfellow, Horatio Bridge, and a future president of the United States—Franklin Pierce. After college, he returned to the family home in Salem. During the next few years, he read widely and wrote a great deal, but he destroyed much of what he wrote.

**Hack-Writing Years**. His first book, *Fanshawe* (1828), was a romantic fictional treatment based upon his years at Bowdoin. It was a failure artistically and financially, and eventually he did his best to withdraw it from circulation. His first short stories, published anonymously in gift books and magazines, attracted little attention. He did various kinds of hack work, serving, for instance, as editor of the *American Magazine of Useful and Entertaining Knowledge* (1836). His short stories were collected and published in *Twice-Told Tales* (1837), only after Horatio Bridge had guaranteed that the publisher would not lose money by issuing the volume. They won little attention. In 1838, Hawthorne became engaged to Sophia Peabody, a Salem neighbor. He received a political appointment and served (1839-40) as weigher and gauger in the Boston Custom House. He attempted



Nathaniel Hawthorne, at age 35, is pictured against a background of *The House of the Seven Gables*, Hawthorne's study, a scene in Salem, *The Old Manse*, Sophia Hawthorne's illustration for "The Gentle Boy," and Salem Custom House

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juvenile writing in *The Whole History of Grandfather's Chair* (1841). Since none of these activities gave him an income sufficient to make possible his marriage, Hawthorne in 1841 invested his savings in the Transcendental community, **BROOK FARM**, and lived and worked there from April to November.

Although Brook Farm, too, failed to solve Hawthorne's financial problem, he determined to postpone his marriage no longer. He and Miss Peabody were married July 9, 1842, and the couple went to live in the "Old Manse" in Concord, Mass. Concord, at the time, was a literary center, the home, notably, of Amos Bronson Alcott, Ralph Waldo Emerson, and Henry David Thoreau, with whom Hawthorne became acquainted. The year 1842 was marked by the publication of *Twice-Told Tales* (second series). Hawthorne remained in Concord until 1846, and most of his stories produced during his residence were collected in *Mosses from an Old Manse* (1846). From Concord, he moved to Salem to take a new political post, as surveyor at the Custom House. He held this position until 1849, and ruefully reminisced about his work in "The Custom House: Introductory to *The Scarlet Letter*," an essay which greatly irritated his fellow townsmen.

**Success at 45.** On losing his appointment because of a political victory by the Whigs, Hawthorne completed a book-length romance he had started in 1847 but had had trouble continuing. This was published as *The Scarlet Letter* (1850) and Hawthorne, accustomed to having his books coolly received, was surprised and delighted to have this one hailed by critics and purchased by many readers. It marked the beginning of wide recognition for him. With his family, he moved to Lenox, Mass., in the Berkshires, where he was a neighbor and associate of Herman Melville, who was even then at work on his masterpiece, *Moby Dick*, which was to be dedicated to Hawthorne. In 1851, Hawthorne's reputation was augmented by the publication of *The House of the Seven Gables* and *A Wonder Book for Boys and Girls*. Returning to Concord, the Hawthornes lived in "The Wayside" (1852-53). The year 1852 saw the publication of a collection of tales, *The Snow Image*, a book-length narrative, *The Blithedale Romance*, the latter of which dealt in fictional form with Hawthorne's memories and impressions of Brook Farm.

The year 1852 also saw the publication of Hawthorne's campaign biography of his former college mate, **FRANKLIN PIERCE**. When Pierce was elected to the presidency, he appointed Hawthorne to the consulship at Liverpool (1853-57). Between 1857 and 1860, the author and his family traveled in Italy and resided in England. His Italian travels furnished details utilized in *The Marble Faun* (1860). The year this novel appeared, he and his family returned to "The Wayside" in Concord. He died at Plymouth, N.H., while on a trip with ex-President Pierce.

**The Novelist of Isolation and Remorse.** Noteworthy in Hawthorne's tales and novels are certain themes and techniques. One theme frequently stressed is the undesirability of the isolation of the individual from his fellows. This theme, like others, is based upon beliefs derived from Hawthorne's own experiences.

Shortly after the death of her husband, Hawthorne's mother had become a recluse: she shut herself up in her room and rarely emerged. Her son, during his boyhood, saw too little of other children and tended to become painfully shy. In college, his life was more normally sociable, but after college, between 1825 and 1839, he lived in seclusion, practically imprisoning himself in his room. By 1837, he was quite worried about his situation. "By some witchcraft or other," he wrote Longfellow, "I have been carried apart from the main current of life, and find it impossible to get back again. Since last we met . . . I have secluded myself from society . . . I have made a captive of myself and put me into a dungeon; and now I cannot find the key to let myself out—and if the door were open, I should be almost afraid to come out . . ." Although he was always quite shy, Hawthorne's work in the Boston and Salem custom houses and his marriage in time brought him into a more normal relationship with society. However, he reiterated in many of his writings the idea that withdrawal from one's fellows was disastrous.

Another interest of Hawthorne frequently important in his fiction was in the nature of sin and atonement. During a period when many intellectuals in New England were Unitarians or Transcendentalists, Hawthorne tended to find validity in beliefs which many of his contemporaries had rejected—the beliefs of his Puritan ancestors. Although not a formal convert to Calvinism, this author, as Prof. Herbert W. Schneider remarks in *The Puritan Mind*, "saw the empirical truth behind the Calvinist symbols. He recovered what Puritans professed but seldom practiced—the spirit of piety, humility, and tragedy in the face of the inscrutable ways of God." Hence in "The Minister's Black Veil," "Young Goodman Brown" and other stories, Hawthorne told of the universal sinfulness of mankind; in *The Scarlet Letter*, of the need by the sinner for both penance and penitence; in *The Marble Faun*, of the genesis of sin; and in other narratives, of other aspects of sin and its expiation.

**An Allegorical Writer.** To develop his themes, Hawthorne cultivated a unique technique. As a boy, he had become acquainted with the writings of some of the great allegorists, particularly Bunyan and Spenser. Basing his method upon suggestions derived from his reading of these authors, he located his stories, as he said, "in a neutral territory, somewhere between the real world and fairy land, where the Actual and the Imaginary may meet, and each imbue itself with the other." Writing of such a world, he could manipulate details in such a fashion—or, as he put it, he could "so manage his atmospherical medium"—as to give details, happenings, characters and settings allegorical significance. Typically, as a result, both his longer and shorter narratives subordinated narrative elements to the development of a concept or set of concepts. "In all my stories, I think," he wrote, "there is one idea running through them like an iron rod, and to which all other ideas are referred or subordinate . . ."

As a consequence of his concepts of his art and his skill in following them, Hawthorne became one



of the great figures in his period, indeed in all periods, in the development of American fiction. He wrote with sure artistry, and everything in each work contributed its share to the achievement of his purpose. R. Stewart edited *The American and English Notebooks of Nathaniel Hawthorne* (1932, 1941). See MASSACHUSETTS for illustration.

WALTER BLAIR  
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**HAWTHORNE**, city, California, Los Angeles County, S of Los Angeles and about 10 miles from the Pacific coast in a truck-farming region. Aircraft, radios, electrical goods, and wooden articles are the chief manufactures. Pop. (1950) 16,316.

**HAWTHORNE**, borough, NE New Jersey, in Passaic County, on the Erie and the New York, Susquehanna, and Western railroads, two miles N of Paterson, in the New York City metropolitan area. Its industries include hosiery, textiles, soaps, machinery, paint, glass, and cement blocks. Pop. (1950) 14,816.

**HAY, JOHN**, 1838–1905, American statesman and diplomat, was born in Salem, Ind., and was educated at Brown University. After graduating in 1858, he studied law in the office of his uncle, Malcolm Hay, at Springfield, Ill., and after a few months in the office of ABRAHAM LINCOLN. During the latter's campaign for the presidency, Hay was his constant companion, and as a result formed a close acquaintance with all the important leaders of the Republican party. In 1861, after being admitted to the Illinois bar, Hay went to Washington as Lincoln's assistant secretary. During the war he was the president's aide de camp and served in the field for short periods, becoming colonel and assistant adjutant general. After Lincoln's death, Hay was sent to Europe as secretary of legation at Paris. Afterward he served as chargé d'affaires at Vienna. In 1870 he returned to the United States and became an editorial writer on the staff of the *New York Tribune*. Five years later he moved to Cleveland, Ohio, where he engaged in literary work. From 1879 to 1881 he served as first assistant secretary of state in President Hayes' administration. In 1897 he was appointed ambassador to England, and in the following year he was recalled to become secretary of state, a post which he held until his death in 1905.



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John Hay

As Secretary of State, Hay won a prominent place among modern diplomats by his candid and tactful conduct of matters of international politics. Among his earliest achievements were the negotiation of a series of extradition treaties, and the settlement of long-standing grievances of American citizens against foreign powers, as the Pious fund claims, the claims against the republic of Salvador, and the Samoan claims. By securing the submission of the Pious fund claims to the international tribunal at The Hague, he established a precedent which went far toward endowing that tribunal with the dignity essential to its future position in the settlement of international disputes. More important, from the American point of view, was his work in securing the abrogation of the CLAYTON-BULWER TREATY, which had proved an insuperable obstacle to the construction of an Isthmian canal, and the negotiation (in 1903) of a new treaty with England permitting the United States to exercise sole control over the canal. The negotiation of a

treaty with Colombia for the cession of land over which to construct the canal (the Hay-Herran Treaty) and the subsequent negotiation of a treaty with Panama (the Hay-Varilla Treaty) further identify the name of Hay with the PANAMA CANAL project. The settlement of the Alaskan boundary dispute and the securing of a peaceful settlement of the dispute between Venezuela and the European powers are further instances of Hay's skillful conduct of diplomatic affairs. See VENEZUELA, *History*; ALASKA.

As a Diplomat Hay's title to distinction rests chiefly upon his success in checking the territorial aggrandizement in China of Western powers, and in maintaining the OPEN DOOR to all nations. In March, 1900, he addressed a circular letter to the powers enunciating the principles that the Chinese government should exercise all the functions of territorial sovereignty, such as the collection of revenue, even in the spheres of influence of Western powers; that citizens or subjects of any foreign nation should enjoy the same rights and immunities in the sphere of influence of any power as were enjoyed by the citizens or subjects of that power; that customs and other taxes, including port and harbor dues, and charges on railways and inland navigation lines, should be uniform for citizens of all foreign powers. The principles contained in the circular were acceded to by every European power having interest in China. After the suppression of the Boxer uprising in 1900, plans for the partition of China, in punishment for the outrages upon foreigners, were considered by certain of the Western powers. Hay steadfastly upheld the rights of China, and was successful in maintaining the territorial integrity of that nation and the open door principle.

Upon the outbreak of hostilities between Russia and Japan, Hay, believing the territorial integrity of China to be in danger, addressed a circular note to the powers urging that they join in insisting upon the limitation of the field of hostilities to Manchuria and Korea. The suggestion was accepted, and the two belligerents bound themselves to such limitation. That no pretext for extending the conflict might be given to either belligerent, Hay upon various occasions urged upon China the necessity of maintaining absolute neutrality.

Hay also gained distinction as a scholar and author. In 1871 he published a volume of poems entitled *Pike County Ballads*; in 1890 a second volume of poems; in 1891 a volume of essays describing Spanish life entitled *Castilian Days*. His most important work, written in collaboration with John G. Nicolay, is *Abraham Lincoln*, published in 1890. This work is one of the most important contributions to the history of the United States for the period from 1830 to 1865, as well as the most trustworthy account of the life and character of Lincoln. See HAY-PAUNCEFOTE TREATY. Tyler Dennett edited *Lincoln and the Civil War in the Diaries and Letters of John Hay* (1939).

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**HAY** is the air-dried grass product of meadows, used for feeding animals. The younger the grass is mown, the better will be the quality of the hay; but if it is allowed to stand until the seed forms, the soluble cellulose, sugar, and extractive matter become converted into indigestible woody fiber. The quality of hay is affected by the nature of the soil, and by the species of grasses and plants composing it. In California and some other localities hay is made from barley and oats which are considered a valuable addition to the forage resources of the farmer. The best hay contains a proportion of CLOVERS and miscellaneous herbage of several kinds interspersed among the leafy parts and the young stems of the grasses proper. It should be secured in dry but not scorching weather, and should heat slightly in the stack or mow. If overmaded, the stack will not settle down to the de-

gree which produces a firm truss, and will lack the aromatic flavor and properties of first-rate hay. Hay improves with age. Among the plants regarded as hay are: timothy, redtop, Kentucky blue grass, orchard

sneeze, the lung may wheeze, the head may ache, or the intestines may react with colic-producing contractions. Unfortunate the patient whose allergy is in all these shock tissues!

#### CHEMICAL COMPOSITION OF HAY

| DESCRIPTION           | WATER | ASH | ALBUMIN-<br>OIDS | CRUDE<br>FIBER | EXTRACTIVE<br>MATTER<br>FREE FROM<br>NITROGEN | FAT |
|-----------------------|-------|-----|------------------|----------------|-----------------------------------------------|-----|
| <i>Meadow hay</i>     |       |     |                  |                |                                               |     |
| poor.....             | 14.3  | 5.0 | 7.5              | 33.5           | 38.2                                          | 1.5 |
| average.....          | 14.3  | 6.2 | 9.7              | 26.3           | 41.6                                          | 2.3 |
| good.....             | 15.0  | 7.0 | 11.7             | 21.9           | 42.3                                          | 2.2 |
| prime.....            | 16.0  | 7.7 | 13.5             | 19.3           | 40.8                                          | 2.6 |
| <i>Red clover hay</i> |       |     |                  |                |                                               |     |
| poor.....             | 15.0  | 5.1 | 11.1             | 28.9           | 37.7                                          | 2.1 |
| average.....          | 16.0  | 5.3 | 12.3             | 26.0           | 38.2                                          | 2.2 |
| good.....             | 16.5  | 6.0 | 13.5             | 24.0           | 37.1                                          | 2.9 |
| prime.....            | 16.5  | 7.0 | 15.3             | 22.2           | 35.8                                          | 3.2 |
| PROTEIN FIBER         |       |     |                  |                |                                               |     |
| <i>Grasses</i>        |       |     |                  |                |                                               |     |
| Timothy.....          | 15.0  | 4.5 | 6.0              | 29.6           | 41.9                                          | 3.0 |
| Redtop.....           | 8.9   | 5.2 | 7.9              | 28.6           | 47.5                                          | 1.9 |
| Ky. blue grass....    | 9.4   | 7.7 | 10.4             | 19.6           | 50.4                                          | 2.5 |
| Orchard grass....     | 9.9   | 6.0 | 8.1              | 32.4           | 41.0                                          | 2.6 |
| Meadow fescue....     | 20.0  | 6.8 | 7.0              | 25.9           | 38.4                                          | 2.7 |
| Brome grass.....      | 11.0  | 9.5 | 11.6             | 30.8           | 35.2                                          | 1.8 |
| Johnson grass....     | 10.2  | 6.1 | 7.2              | 28.5           | 45.9                                          | 2.1 |
| <i>Legumes</i>        |       |     |                  |                |                                               |     |
| Alfalfa.....          | 8.4   | 7.4 | 14.3             | 25.0           | 42.7                                          | 2.2 |
| Red clover.....       | 20.8  | 6.6 | 12.4             | 21.9           | 33.8                                          | 4.5 |
| Crimson clover...     | 9.6   | 8.6 | 15.2             | 27.2           | 36.6                                          | 2.8 |
| Cow pea.....          | 10.7  | 7.5 | 16.6             | 20.1           | 42.2                                          | 2.9 |
| Soy bean.....         | 11.3  | 7.2 | 15.4             | 22.3           | 38.6                                          | 5.2 |
| Barley.....           | 10.6  | 5.3 | 9.3              | 23.6           | 48.7                                          | 2.5 |
| Oats.....             | 16.0  | 6.1 | 7.4              | 27.2           | 40.6                                          | 2.7 |

grass, meadow fescue, brome grass, Johnson grass, alfalfa, red clover, crimson clover, cow pea, soybean, barley, and oats. See ALFALFA.

**HAY FEVER** is a form of allergy affecting the respiratory system. **ALLERGY** is a condition resulting from exaggerated sensitivity to foreign proteins or chemicals which are harmless to most individuals. Thus, ragweed pollen, the cause of much hay fever, is harmless to about 96 per cent of the population, but causes much trouble to the 4 per cent who are allergic to it. About 10 per cent of the entire U.S. population—that is, about 14 million people—have some form of allergic disturbance. Very little is known about the difference between the allergic 10 per cent and the unaffected 90 per cent of the population except that those in the allergic group inherit their tendency to become oversensitive, or allergic. One or both parents, a grandparent, or some other close relative is also allergic. It is the allergic tendency—not the sickness—that is inherited. Thus the father may have ECZEMA and the son ASTHMA.

Allergic conditions are classified according to the part of the body affected—the “shock tissue.” If the “shock tissue” is in the breathing system, the allergy is hay fever or asthma. Reaction in the digestive tract—usually to a food allergen—is gastro-intestinal allergy. Reactions in the skin may cause eczema or hives. If the “shock tissue” is in the brain, an allergic headache, often called MIGRAINE, may occur. The symptoms of the allergic reaction, therefore, depend not on the offending substance, but on the location of the reaction. Exposed to an offending foreign protein, or allergen, the nose may

Commonest allergic symptoms are found in the nose and lungs. If the condition results from pollen (such as ragweed) occurring during a certain season, the condition is called *seasonal hay fever* (in the nose) or *seasonal bronchial asthma* (in the bronchial tubes). If the patient is sensitive to a substance encountered all year around, like pillow feathers, a household pet, or a common food, the condition occurs throughout the year and is called a *perennial allergic rhinitis*. It is really an all year around hay fever or asthma.

**Symptoms** of nasal allergy, either seasonal or perennial, are the same. The nose is stuffy, frequently with excessive watery secretion. Often eyes, nose, or throat itch. These symptoms usually are most intense on awakening in the morning and when the patient tries, often in vain, to go to sleep in the evening. Bronchial asthma is closely related to nasal allergy. About 40 per cent of the patients with nasal allergy develop the more serious bronchial condition as the allergic reaction spreads over a wider area and involves more of the respiratory tract. Bronchial asthma is marked by difficulty in breathing as the lining of the bronchial tubes swells, narrowing the air passages. Coughing and wheezing are frequent and often severe.

**Diagnosis** is often difficult. By questioning the patient, “taking a history,” cross-examining him in minute details, the doctor often gets clues. He can then make tests on the patient’s skin with solutions of the suspected substances (*allergenic extracts*). These solutions may be applied to tiny scratches on the skin (*scratch test*), or may be injected in tiny drops very superficially under the outermost layers of the skin (*intradermal test*). If the patient is sensitive, a positive skin reaction resembling a mosquito bite appears at the tested point in 10 to 20 minutes. Another test is the *patch test*. This is made in cases of eczema caused by external agents (contact dermatitis) such as poison ivy or dyes. The suspected material is placed on the patient’s back and covered by an adhesive “patch.” After 48 hours or less the area is examined for little blisters as an indication of a positive reaction.

**Treatment** depends largely on the cause. In some cases the substance to which the patient is sensitive, or allergic, can be eliminated. These include house-



Ragweed pollen spore (enlarged) causes sneeze, right

WESTINGHOUSE



hold pets, feathers, or even important foods. When the cause of symptoms is some substance that cannot be eliminated (pollen, for example), injections of gradually increased dosage build up the patient's tolerance to the offending substance, "desensitizing" him.

There are various measures used to relieve symptoms. The most useful drug in allergy is ADRENALINE. An injection of this often produces spectacular relief of even severe asthma or hives. However, the most important measure in the treatment of any allergic condition is the painstaking, diligent detective work that discovers the cause of the symptoms. If the diagnosis is accurate, the treatment usually succeeds. See HISTAMINE AND ANTI-HISTAMINE DRUGS.

B. Z. RAPPAPORT, M.D.

**HAY-PAUNCEFOTE TREATY**, a treaty between Great Britain and the United States according to the provisions of which Great Britain renounced the right, guaranteed by the CLAYTON-BULWER TREATY, to join with the United States in the construction and control of any canal which might be constructed uniting the waters of the Atlantic and the Pacific. The negotiations were conducted by JOHN HAY, secretary of state, on the part of the United States, and by Lord PAUNCEFOTE, British minister to the United States, on the part of Great Britain. According to the original treaty, as signed by the negotiators, February 5, 1900, the United States agreed to unite with Great Britain in guaranteeing the neutrality of the canal, and to invite other nations to join in this guaranty. The latter provision aroused a great deal of opposition in America, as a departure from the traditional policy of the United States in avoiding entangling alliances with foreign nations; and the treaty was accordingly amended by the U.S. Senate so as to leave with the United States alone the right of maintaining the neutrality of the canal, and specifically abrogating the Clayton-Bulwer treaty. The treaty, as thus amended, was rejected by Great Britain, March 11, 1901. A new treaty was then negotiated (signed Nov. 18, 1901), providing for the abrogation of the Clayton-Bulwer treaty, and assuring to the United States sole control of the canal, and sole right of maintaining its neutrality. The United States, on the other hand, engaged to adopt substantially the same rules governing the equal rights of all nations in the navigation of the canal as govern the navigation of the Suez Canal, making the canal "free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality."

In this form the treaty was acceptable to Great Britain, and it was ratified by the U.S. Senate on December 16, 1901.

The Panama Canal Act of 1912, which provided for the exemption of American vessels engaged in domestic commerce from canal tolls, was considered by Great Britain to be a violation of the terms of the Hay-Pauncefote treaty, and was repealed (1914). See PANAMA CANAL.

**HAY RIVER**, Canada, rises in NE British Columbia and flows NE about 350 miles across Alberta to enter Great Slave Lake in the district of Mackenzie. Alexandra Falls, located about 30 miles from the mouth, is about 150 feet high.

**HAYDEN, FERDINAND VANDEVEER**, 1829–87, American geologist, was born in Westfield, Mass., and studied at Oberlin College. From 1853 to 1879, with the exception of the time spent as a surgeon in the Union Army during the Civil War, he explored the Rocky Mountains, the Black Hills, and Bad Lands. He reached the headquarters of the Yellowstone, Madison, and Gallatin rivers in Montana and was largely responsible for the setting aside of the area now known as YELLOWSTONE NATIONAL PARK. Hayden was professor of geology at the University of Pennsylvania (1865–72) and remained with the U.S. Geological Survey until 1886. He edited the first eight reports of surveys made in Nebraska and other

territories (1867–76). A moth and a fossil dinosaur were some of the 44 genera and species named for him.

**HAYDEN FOUNDATION**, in full **Charles Hayden Foundation**, a charitable institution established in 1937 in New York City to assist needy boys and young men in attaining moral, intellectual, and physical well-being through scholarships, and through financial aid to educational institutions, recreation centers, gymnasiums, clubs, and hospitals. Because the founder, Charles Hayden, was particularly interested in boys' clubs, present activities are confined to that work by the trustees. Preference is given to activities within New York City and Boston, although provision has been made to extend its work to other places in the United States.

**HAYDN, FRANZ JOSEPH**, 1732–1809, Austrian composer, called the "father of the SYMPHONY," was born in Rohrau of extremely poor parents. He showed such aptitude for music that at the age of six he was sent to Hainburg to study with a distant relative who



Haydn

was a teacher, choirmaster, and strict disciplinarian, and who exacted the utmost from Haydn. Haydn's high spirits remained undaunted, despite the fact that he was constantly invoking the director's wrath. When at 17, he snipped off the pigtail of one of the other choristers he was summarily dismissed. Thrown upon his own resources in Vienna, a friendly musician gave him lodging, and Haydn took whatever musical odd jobs he could find to meet his bare necessities. His most treasured pos-

sessions were six sonatas of Carl Philipp Emanuel Bach, which he studied until he had absorbed their style. Already he had begun to compose.

**First Symphony.** For a time he studied with Nicola Porpora, a noted voice teacher, repaying the testy old man by serving him as valet and accompanist. Here he met, among others, the great Gluck (who had not yet embarked upon his operatic reforms), and a rich Austrian, Karl von Fournberg. The latter engaged him, in 1755, as music director of his country estate. During the year that he remained in this position Haydn composed his first string quartets, and gradually began the evolution of the orchestral suite which eventually resulted in the symphony. Returning to Vienna, he devoted most of his time, for the next three years, to teaching. In 1759 he was employed by a Bohemian, Count von Morzin, as music director and composer. Here he composed his First Symphony at the age of 27. By this time Haydn had decided to marry, and had even settled upon the girl. She unco-operatively entered a convent, however, but her father persuaded Haydn to marry the older sister, a shrewish woman three years older than he. The marriage was doomed to failure from the start, and after several years the two separated by mutual agreement.

**Accomplishments of Esterházy.** The year 1761 found Count von Morzin faced with financial problems which resulted in the dismissal of Haydn from his employ. The composer was soon engaged as second Kapellmeister by Prince Paul Anton Esterházy, and went to Eisenstadt where he was to live for the next 30 years. Within a year Prince Paul died and was succeeded by his brother, Nicholas, who immediately undertook to make his estate as imposing as his brother's had been. Prince Nicholas, a music lover and performer of sorts, built a marionette theater and an opera house designed to seat 400 people. When, in 1766, Haydn became Kapellmeister he found himself responsible, not only for directing the orchestra and composing for it, but for all the details of managing it and supervising its personnel.

Many of the famous people of the time were entertained at Esterházy, and through them Haydn's name was beginning to be known throughout Europe. One of the most important of these visitors was Mozart. The names of Mozart and Haydn are often linked together, for they were the founders of the classic symphony. It should be remembered, however, that, while each was greatly influenced by the other, Haydn was the forerunner, as well as the contemporary and the successor, of Mozart.

When Prince Nicholas died in 1790, Haydn returned to Vienna where he again devoted himself to teaching. His 30 years at Esterházy had seen the production of more than 20 operas (none of great importance, since Haydn had no gift for composition of this type), and almost 90 symphonies, besides numerous quartets, trios, piano sonatas, and various other works. Many of these compositions are admittedly inferior. The wonder is that there is so much that is good, for he had always to work hurriedly, usually trying to complete a work in time for a particular performance.

**Works in England.** At 58, Haydn set out on his first trip to England, where, after some slight opposition, he was well received. Oxford University bestowed upon him the degree of Doctor of Music, on which occasion was performed the symphony which came to be known as the "Oxford Symphony." After a year and a half in England Haydn returned to Vienna, where, for a short period, Beethoven was his pupil. Beethoven later stated that he learned nothing from Haydn, and Haydn failed to understand his pupil's musical theories, which he considered radical.

In 1794, when the impresario, Salomon, offered him a lucrative new contract he returned to England, and this time his public, from the royal family down, was lavish in its praise. Although most of his time, during these two trips, was devoted to social activity, he still found time to write the 12 "Salomon Symphonies" which are played more often than all the symphonies composed at Esterházy combined. Haydn's fun-loving nature is reflected in the "Surprise Symphony" in which he gently makes fun of the British proclivity for napping during a performance. For the first time he was a free man, writing when and as he wished. The new circumstances of his living appear to have had a happy effect upon his work. The improved structure of his later symphonies also reflects, to no slight extent, the influence of Mozart.

**Oratorios.** After his return from London Haydn began to work on the ORATORIO, *The Creation*, the text for which was an adaptation of Milton's *Paradise Lost*. Even before its performance he was busy composing *The Seasons*, hastening to write as much as possible before old age or death should stay his hand. Both works were immensely successful, but they left Haydn an enfeebled old man. Virtually helpless, he lived on for a few years more and died in Vienna.

**Analysis of Symphonic Style.** The most delightful element in Haydn's symphonies is the ingenious thematic development of popular airs. He utilized many folk tunes which he remembered from his rustic childhood days, and incorporated them into his works, varying them to express every possible mood. Through this method, Haydn gave the symphony, which had been Italian in form and spirit, a distinctly German touch. Furthermore, Haydn always began his symphonies with a short, slow, and dignified introduction. In his middle slow movement he frequently used the variation form, which he took over from chamber music. Haydn wrote many of his earlier symphonies and chamber music in the thorough bass system, but later this method of writing disappeared permanently. The harpsichord, which up to his time had been an indispensable part of the ORCHESTRA—in fact, the orchestra was directed by the conductor who played the harpsichord himself—vanished in Haydn's day. Thus the modern orchestra was evolved and subse-

quently enlarged to the full scope it has now. Haydn recognized the merit of Mozart's weaving a *cantabile* melody into the rapid theme of a symphony, and adopted it in his own symphonies, thus introducing a charming element of contrast and preparing the path for Beethoven. See MUSIC, German.

ATTIE LEA BRASHEARS

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**HAYDON, BENJAMIN ROBERT**, 1786–1846, English painter, was born in Plymouth. Admitted a student of the Royal Academy (1805), he exhibited his first picture in 1807. Excessively vain, and flattered by fashionable people, he believed that his *Dentatus* (1809) would mark an epoch in English art. But the Academy gave it an indifferent position, fashion deserted him, and he began a lifelong struggle with debt. *The Judgment of Solomon* (1814) won praise, but *Christ's Entry into Jerusalem* (1820), the fruit of six years' labors, although it made a large sum on exhibition, proved unsalable; and upon the completion (1823) of *The Raising of Lazarus*, Haydon was arrested for debt. He suffered another heavy blow when his historical cartoons for the decoration of the new Houses of Parliament, his life's ambition, were rejected. Desperate with debt, and unable to paint, he died by his own hand. Haydon had an important influence on English art through his lectures on design, which were later published.

**HAYES, HELEN**, born Helen Hayes Brown, 1900—, American actress, was born in Washington, D.C., and at the age of six made her stage debut



Helen Hayes

in that city—with the Columbia Players. In 1908 she appeared in the Lew Fields' production, *Old Dutch*, and this was followed by roles in *The Summer Widowers* (1909), *The Nevers Homes* (1910), and *The June Bride* (1912). In 1917 she graduated from the Sacred Heart Academy in Washington and that same year was engaged for the title role in *Pollyanna*. A year later she achieved her first great success in *Dear Brutus*, and from that time her career was assured. Since then she has taken leading parts in such plays as *Dancing Mothers* (1924), *What Every Woman Knows* (1926), *Mary of Scotland* (1933), *Victoria Regina* (which opened in 1935 and ran almost continuously to 1939), *Twelfth Night* (1940), *Harriet* (1943), *Happy Birthday* (1946), *Glass Menagerie* (1948), and *The Wisteria Trees* (1950). Her movie career included notable film characterizations in such pictures as *Farewell to Arms*, *Arrowsmith*, and *The Sin of Madelon Claudet*, the last of which won for her the outstanding actress award of the Academy of Motion Picture Arts and Sciences for the year 1931–32. She was married in 1928 to the writer CHARLES MACARTHUR.

**HAYES, PATRICK JOSEPH**, 1867–1938, American Roman Catholic cardinal, was born in New York City. He was educated at Manhattan College and was ordained priest in 1892. After serving in St. Gabriel's, New York City, in 1904 he was made president of the newly opened Cathedral College and filled that office until 1914 when he became rector of St. Stephen's Church, New York City. He was Catholic chaplain bishop for the U.S. Army and Navy during World War I, and in 1919 became archbishop of New York. In 1924 he was made a cardinal.

**HAYES, ROLAND**, 1889—, American Negro tenor, was born in Georgia. After receiving his musical education at Fisk University, he gave his first concert in Boston. He was immediately recognized as a remarkable artist, and he soon became known throughout America and abroad.





CHICAGO HIST. SOC.

## RUTHERFORD BIRCHARD HAYES

### 19th President of the United States

### 1877—1881

**HAYES, RUTHERFORD BIRCHARD**, 1822–93, 19th president of the United States. Born on October 4, in Delaware, Ohio, to Rutherford Hayes and Sophia Birchard, an old New England family of farmers, he attended Kenyon College and, for two years, Harvard Law School. After early difficulties in starting a law career in Lower Sandusky (now Fremont), Ohio, he established a modest practice in Cincinnati after 1850, marrying Lucy Webb and raising a family of eight children. During the 1850's he joined the Whigs, and after the Kansas-Nebraska Act of 1854 had split party lines he swung over to the new Republican Party on the slavery issue. He fought valiantly in the Civil War, being wounded four times, and emerged as a brevet major general of volunteers; altogether a strong military record, which was to aid him politically.

Scarcely had the war ended before the powerful Cincinnati Republican machine elected him congressman during 1865–67; his orthodox party record pleased the radical party. In 1867 he became governor of Ohio and was re-elected with sharply rising majorities in 1869 and 1875—three terms in all. As governor he showed a genuine reformist spirit, and fought the corrupt spoils system by backing an independent civil service and a program of economy.

The year 1876 was ideal politically for a man like Hayes. Grant's scandal-filled regime was ending amid severe criticism, and the Democrats, encouraged by their victories in 1874, were confident of ousting the Republicans on the issue of reform. Senator John Sherman of Ohio and other Republican leaders, anxious to prevent the nomination of the scandal-tarred James G. Blaine, threw their strength to Hayes and nominated him at Cincinnati on the seventh ballot. The Democratic presidential candidate was SAMUEL J. TILDEN of New York. The Democratic tide seemed to have engulfed Hayes on election night, but the Democratic leaders were uncertain regarding the results in the carpetbag states of the South, and Zachary Chandler, national Republican chairman, decided to claim all disputed votes for Hayes and therefore announced a victory over Tilden. Congress set up an ELECTORAL COMMISSION of 15, chosen from both parties, to decide the victor, and this arbitration body by a persistent eight to seven vote gave Hayes every disputed vote in Louisiana, South Carolina, Florida, and one in Oregon. Hayes needed every one of these to get the necessary 185 to beat Tilden.

**The Presidency.** President Hayes was called "Old 8 to 7" by critics, yet he proved an able and honest executive. He fought the spoilsman under Senator ROSCOE CONKLING, who had dominated Grant, and courageously struck at his own party's chief source of funds, the New York Custom House, by ousting the heads, CHESTER A. ARTHUR (later president) and A. B.

Cornell, and by demanding that the collection of all government revenues be taken from the control of party leaders. When Conkling fought back in the Senate to block Hayes' new appointees in the name of "senatorial courtesy," the president stood his ground and won a battle that freed the chief executive from the control of the Senate cabal.

His able cabinet included CARL SCHURZ, a champion of civil service reform, as secretary of the interior, and an ex-Confederate, David M. Key, as postmaster general. For the South, he carried out an informal pledge of his campaign managers to withdraw all remaining Federal troops, thus ending the painful episode of RECONSTRUCTION at the cost of deserting the Negro voter. His economic conservatism appeared in his vigorous use of Federal troops to break strikes in four states during the great railroad riots of 1877. Silver inflationists found Hayes unyielding, for he vetoed (unsuccessfully as it turned out) the Bland-Allison Silver Bill of 1878 and pushed the resumption of specie payments for government bonds as an anti-inflationary measure.

Hayes had determined from the beginning to serve only one term, and in 1881 he retired to private life and thereafter devoted himself to such humanitarian causes as Negro education and prison reform. C. R. Williams edited *Diary and Letters of Rutherford B. Hayes* (5 vols. 1922–26).

A monument has been erected on the site of the birthplace of President Hayes in Delaware, Ohio. His former estate at Fremont, Ohio, containing the Hayes house and Hayes Memorial Museum, is now Spiegel Grove Estate Park. See UNITED STATES HISTORY.

S. W. X.

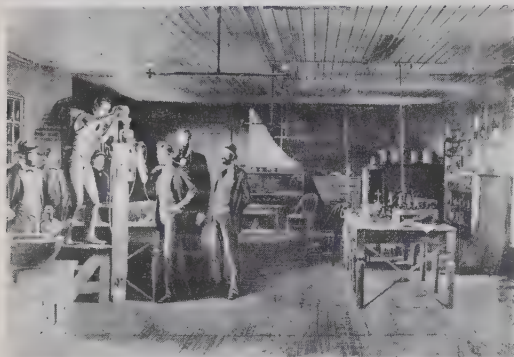
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**HAYES, MOUNT**, mountain peak, (alt. 13,740 ft.), Alaska, NE of Mount McKinley, about 50 miles SW of the junction of the Alaska Highway and the Richardson Highway.

**HAYLEY, WILLIAM**, 1745–1820, English writer, won contemporary fame with his *Triumphs of Temper* (1781), *Essay on Old Maids* (1785), *Life of Milton* (1794), and *Life of Cowper* (1803).

**HAYMARKET RIOT**, an incident which occurred May 4, 1886, in Chicago, Ill., in which a bomb thrown by an unknown hand during labor strife resulted in the death of eight policemen. The militant eight-hour-day movement, many of the leaders of which were avowed anarchists, was advocating a GENERAL STRIKE for the enforcement of its demands; employers countered by making plans for the hiring of a mass of strikebreakers. On May 1, 1886, began a strike of 100,000 workers, of whom 58,000 were in Chicago.

It happened when  
**Rutherford B. Hayes**  
 was president . . .



GENERAL ELECTRIC  
**Final Experiment in the manufacture of Edison's efficient incandescent light was completed in 1878**



LESLIE'S ILLUSTRATED WEEKLY  
**Return of Governor Hampton in 1877 marked the end of the era of carpetbag rule in South Carolina**

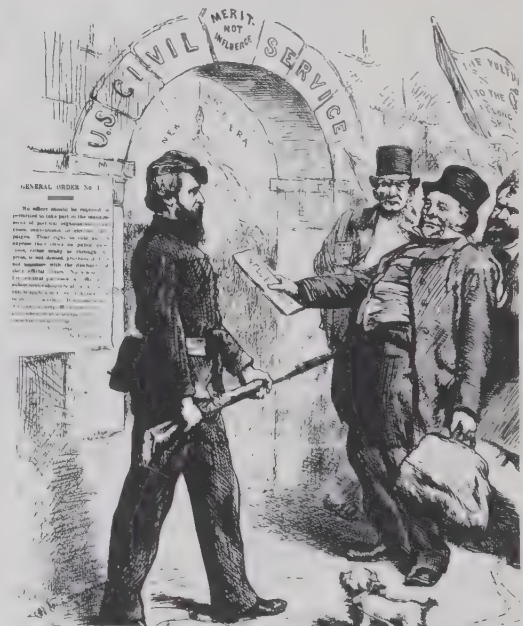


**WHY TAKE A CROOKED ROAD WHEN THERE IS A STRAIGHT ONE?**

F. J. MEINE  
**Gold Versus Silver was a controversial issue in 1878 when Hayes vetoed the Bland-Allison Silver Bill**



LESLIE'S ILLUSTRATED WEEKLY  
**Telephone Connection between Salem and Boston was made by Bell in 1877 from Lyceum Hall, Salem**



F. J. MEINE  
**Civil Service Reform, instituted by Hayes, was first step toward final defeat of the spoils system**

**Northern Pacific before 1882 crossed the Missouri in summer by boat; in winter, by tracks laid on ice**  
 NORTHERN PACIFIC RY.





On May 3, a conflict between police and strikers near the McCormick reaper plant in Chicago caused the death of six strikers. The next evening a meeting was held (on Des Plaines street between Lake and Randolph streets) "to denounce the latest atrocious act of the police." Mayor Carter Harrison attended but left early because he held that nothing was likely to occur which would require interference. Nevertheless Captain Bonfield marched a band of about 200 policemen from the near-by Des Plaines station and ordered the crowd to disperse. A moment later a bomb was thrown into the midst of the police, causing the death of eight and wounding about 65 others. Immediately eight persons—August Spies, Albert Parsons, Samuel Fielden, George Engel, Oscar Neebe, Michael Schwab, Louis Lingg, and Adolph Fischer—were arrested as the leaders of the movement and were charged with conspiracy. A fair hearing was impossible because of the inflamed state of public opinion; hence seven were sentenced to death and Neebe was given a 15-year prison sentence. The state Supreme Court affirmed the sentences. Spies, Engel, Parsons, and Fischer were hanged on Nov. 11, 1887, Lingg cheated the gallows by committing suicide. Governor Oglesby had commuted the sentences of Schwab and Fielden to life imprisonment. After JOHN P. ALTGELD became governor he made an investigation of the trial; in 1893 he pardoned Neebe, Schwab, and Fielden and accompanied his action by an 18,000 word document in which he charged that gross irregularities had occurred in the trial conducted by Judge Joseph E. Gary. The Haymarket Riot has been a *cause célèbre* for the radical labor movement, and the executed men have been hailed as martyrs. The name of the person who actually threw the bomb, although known by a few among the radical leaders, was never revealed until May, 1947, when a Chicago columnist published the story. The bomb thrower, according to this report, was Rudolph Schnaubelt, a brother-in-law of Schwab. He was arrested at the time but was released because the police regarded him as a mere "windbag." Schnaubelt was later suspected, but could not be found.

F. M.

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**HAYNAU, JULIUS KJAKOB, BARON VON**, 1786–1853, Austrian general, was a natural son of William I, Elector of Hesse. He entered the Austrian service and attained the rank of field marshal lieutenant (1844). During the Italian campaign of 1848–49 he acquired a reputation for cruelty, especially in the repression of the insurrection at Brescia. Called to command the Imperial forces, he turned the tide of war by the storming of Raab (June, 1849) and the victories at Szegeidin (Aug. 3, 1849), and Temesvár (Aug. 9, 1849).

**HAYNE, PAUL HAMILTON**, 1831–86, American poet, was born in Charleston, S.C. At first he studied law, but soon turned to writing. He edited *Russell's Magazine*, and afterward the *Charleston Literary Gazette*, and contributed frequently to Southern newspapers and periodicals, notably the *Southern Literary Messenger*. Collections of his poems appeared in 1855, 1857, and 1859. During the Civil War he was on the staff of General Pickens, but his health was soon shattered by the hardships of service, and he unwillingly resigned. His house, his books, and virtually all his belongings were destroyed during the bombardment and capture of Charleston, and he thereupon went with his family to Augusta, Ga., settled on a little estate near that city, and there spent the remainder of his life. His books include *Legends and Lyrics* (1872), *The Mountain of the Lovers* (1873), and his complete *Poetical Works* (1882).

**HAYNE, ROBERT YOUNG**, 1791–1839, American statesman, was born in St. Paul's parish, Colleton district, S.C. He was admitted to the South Carolina bar in 1812, attained prominence as a lawyer, was a member of the state legislature (1814–18), and was attorney general of South Carolina (1818–22), and

U.S. senator (1823–32) from that state. A determined advocate of states' rights and a vigorous opponent of protection, he was engaged with DANIEL WEBSTER in January, 1830, in one of the most famous debates in American history, in which he gave able expression to the STATES' RIGHTS, strict construction view of the Federal Constitution. He was one of the leaders of the movement in South Carolina for the nullification of the 1832 tariff bill, and, a convention in South Carolina having passed a NULLIFICATION ordinance, he was elected governor, serving from December 1832, to December 1834. Subsequently Hayne was mayor of Charleston (1835–37) and president of the Louisville, Cincinnati, and Charleston Railroad (1837–39).

**HAYNES, ELWOOD**, 1857–1925, American inventor, was born in Portland, Ind., and studied at Worcester Polytechnic Institute. He designed and constructed a gasoline AUTOMOBILE (1893–94), which he later gave to the Smithsonian Institution. Haynes started his own factory in 1895, and later improved both design and construction of his "horseless carriage." He was the discoverer of several alloys, including tungsten chrome steel, alloy of cobalt and chromium, and alloys of cobalt, chromium, and molybdenum. He patented "stainless steel" in 1919.

**HAYNES, JOHN**, d. 1654, first governor of Connecticut Colony, was born in Copford Hall, Essex, England, and in 1633 emigrated to the Massachusetts Bay Colony, of which he was assistant governor in 1634 and governor in 1635. He founded the colony of Connecticut in 1636, was one of the five who formulated its constitution, and became its first governor (1639). He served as governor during each alternate year, which was as often as the law allowed, until his death, and was greatly beloved by the colonists.

**HAYS, WILL HARRISON**, 1879–1954, American lawyer and public official, was born in Sullivan, Ind. He was graduated from Wabash College and was later admitted to the bar. After several years of law practice he turned to politics and was made chairman of the Republican National Committee. He eventually became postmaster general in President Harding's cabinet (1921–22), a post which he resigned to accept the presidency of the Motion Picture Producers and Distributors of America, Inc. In this position he served as censor and with the aid of religious and national organizations did much to raise the standards of early motion pictures. In the years that followed, his office became a moving force in the industry. He was succeeded by Eric Johnston in 1945. See MOTION PICTURES.

**HAYS**, city, N central Kansas, county seat of Ellis County; on the Union Pacific Railroad and U.S. highways 40 and 183, near the eastern edge of the Great Plains and about 85 miles W of Salina. Hays is a trading center for a farming, stock raising, and oil-producing area. The city was founded in 1867 as the outgrowth of FORT HAYS, a frontier military post. South of the city is Fort Hays State College for teachers (1901) and Fort Hays Agricultural Experiment Station. Pop. (1950) 8,625.

**HAYS, FORT**, military post built in western Kansas in 1867 by Gen. John Pope as one of a system of forts to combat the hostile Plains Indians. For a time Gen. PHILIP SHERIDAN, in command of the department of the Missouri, made his headquarters at Fort Hays while conducting operations against the Cheyennes, Comanches, Arapahoes, and Kiowas; Gen. GEORGE A. CUSTER was another prominent military figure associated with this post. Here also JAMES BUTLER "WILD BILL" HICKOK began his career as a frontier marshal in 1869, but he was soon forced to flee because his activities brought him into conflict with Sheridan. When the Kansas Pacific Railroad reached this point the town of Hays sprang up and soon became the most turbulent settlement on the Plains. The fort was abandoned in 1889 with the ending of the Indian wars. In 1900 the 7,000-acre military reservation was given to the state of Kansas

for educational and scientific purposes; from this grant has sprung the Fort Hays State College and the Fort Hays Agricultural Experiment Station. See KANSAS, *History*.

BEATRICE WHITACRE

**HAYWARD, ABRAHAM**, 1801–84, English essayist, was born in Wilton and was called to the bar in 1832. He was a busy contributor to magazines and newspapers, and a brilliant conversationalist. Among his best works are *The Art of Dining* (1852), *Biographical and Critical Essays* (5 vols. 1858–74), and *Sketches of Eminent Statesmen and Writers* (2 vols. 1880).

**HAYWARD**, city, W California, in Alameda County, near San Francisco Bay, on the Southern Pacific and the Western Pacific railroads and U.S. Highway 50; about 20 miles SE of San Francisco. Hayward, one of the largest poultry centers in the United States, was founded in 1854 by Guillermo Castro and named for his friend, William Hayward. Pop. (1950) 14,272.

**HAYWOOD, WILLIAM DUDLEY**, 1869–1928, American labor agitator, was born in Salt Lake City, Utah. He became an active leader of the Western Federation of Miners, advocating a policy of violence. In 1905 he helped found the INDUSTRIAL WORKERS OF THE WORLD. His trial, when he and others were accused of instigating the assassination of the former governor of Idaho, caused nationwide interest. Acquitted, Haywood later campaigned for the Socialist party and the I.W.W. Charged with sedition when he was secretary of the I.W.W., he was given a 20-year sentence (1918). However, he jumped bail (1921) and went to Russia.

**HAZARD**, city, SE Kentucky, county seat of Perry County, in the Cumberland Mountains; on the Kentucky River and the Louisville and Nashville Railroad, about 145 miles SE of Lexington in one of the country's richest coal fields. Hazard was named for Oliver Hazard Perry by men who served under him in the Battle of Lake Erie (1813). Natural gas was discovered near the city soon after the Civil War, and in 1917 oil was found. Large quantities of hardwood timber are cut in the neighborhood. Hazard has oil refineries and a steel mill. Pop. (1950) 6,985.

**HAZE**, an atmospheric condition resulting in low visibility, due to the presence of countless minute particles in the air. Haze differs from fog or mist in that it is dry or almost without condensation. Dust is the common cause of haze but it may also result from the presence of layers of warm and cold air within the line of vision. The gases in the air, because of their influence on light, affect visibility and are capable of producing haze. Haze usually occurs when dry weather prevails. It may be caused by floating particles of fine ash resulting from forest fires, and is sometimes due to mineral dust from deserts or volcanoes. On rare occasions a stratum of haze forms at a great elevation above the earth, while the lower atmospheric strata remain unusually clear.

The period of the year known as Indian Summer is characterized by haze. A thin, extensive, high cloud of ice particles is known as a cirrus haze.

D. M. MACMASTER

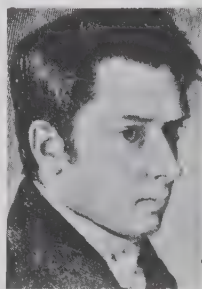
**HAZEL**, a genus of small trees or shrubs of the family *Betulaceae*, including a number of North American and European species. They bear rough, nearly circular leaves, yellow male catkins, and tiny crimson female flowers, which are followed by the fruit in the form of the well-known hazelnuts. There are three species in North America, having the nut enclosed in broad compressed involucre consisting of a pair of leaflike, incised, and pubescent bracts, or by bracts prolonged beyond the nut into a long tube. Two species of American hazel are *Corylus americana* and *C. cornuta*, which produce small nuts, but are of no commercial value. A larger European species, *C. avellana*, is the FILBERT of commerce. Most of the cultivated varieties of hazelnuts are known as filberts. The oil of the nut is used by painters on account of its drying properties, and also in the making of perfumes.

**HAZEL PARK**, city, SE Michigan, in Wayne County; lying NW of Detroit, of which it is a residential suburb. The city, covering three square miles, was laid out in the 1930's and incorporated in 1942; it has a council-manager form of government. Pop. (1950) 17,770.

**HAZEN, WILLIAM BABCOCK**, 1830–1887, American soldier, was born in West Hartford, Vt. After graduation from West Point (1855), he served as an Indian fighter in the West. In the Civil War, as colonel of the 41st Ohio Volunteers, and later as major general of volunteers, he participated in the Mississippi battles and in the march through Georgia. He served on the western plains after 1865, and in 1870 took over the command of Fort Buford, Dakota Territory. His reports on corruption in the post-trader system led to the impeachment of Secretary of War WILLIAM W. BELKNAP. In 1880 Hazen was appointed chief signal officer of the army, with the rank of brigadier general. In this capacity he organized the Greely Arctic expedition of 1881. Four years later he was court-martialed for criticizing Secretary of War Robert Lincoln for tardiness in sending relief parties to Greely; he was reprimanded by the president, but continued in office. Hazen wrote *A Narrative of Military Service* (1885). See GREELY, ADOLPHUS W.

**HAZLETON**, city, NE Pennsylvania, in Luzerne County, on the Lehigh Valley and the Pennsylvania railroads and U.S. Highway 309, about 25 miles S of Wilkes-Barre. Hazleton is situated at an altitude of 1,800 feet on a broad tableland on Buck Mountain. It was settled about 1830, was named for Hazel Creek and was incorporated in 1892. It is one of the chief centers of anthracite coal mining. Coal is said to have been first discovered here when a deer pawed some earth in the vicinity in 1818. Other industries include the manufacture of silks and velvets, knit goods, clothing, iron and steel, shoes, and centrifugal pumps. Pop. (1950) 35,491.

**HAZLITT, WILLIAM**, 1778–1830, English art and literary critic, essayist, was born in Maidstone. Educated for the ministry, he turned to portrait painting, then to literature as a profession.



William Hazlitt

Early in his career Hazlitt joined with the group of liberal English writers who believed in the principles of the French Revolution, which he supported in contributions to journals and in some of his lesser works. Separated from his wife, he became involved in an ill-fated love affair, described at length in *Liber amoris* (1823). Earlier he wrote dramatic criticism for the *Morning Chronicle* and lectured on the theater, his chief works from this period being *The Characters of Shakespeare's Plays* (1817) and *The English Comic Writers* (1819).

As a critic Hazlitt belongs to the romantic school of Coleridge and Lamb, and with them helped to establish in his day a sound appreciation of the Elizabethan drama. His greatness as a familiar essayist is being increasingly recognized. Less lovable than Lamb, he had more imaginative vision and his essays have a firmer intellectual texture. Though he was frequently unamiable in personal relationships, his essays reflect a sense of humor and a likable, enthusiastic nature. Notable among them are "My First Acquaintance with Poets," "On Gusto," "On Going a Journey," "On Disagreeable People," "On the Pleasure of Hating," "On the Feeling of Immortality in Youth." See ESSAY.

LOUIS A. LANDA

BIBLIOG.—G. M. Maclean, *Born Under Saturn: A Biography of William Hazlitt* (1944).

**HEAD, Sir HENRY**, 1861–1940, British neurologist, was educated at Trinity College, Cambridge, the



# THE HUMAN HEAD

## In Anatomical Transparencies

Illustrations and Text  
By GLADYS McHUGH

Based on dissection studies for *The Human Ear in Anatomical Transparencies* by Polyak, McHugh, and Judd, published under the auspices of the Sonotone Corporation

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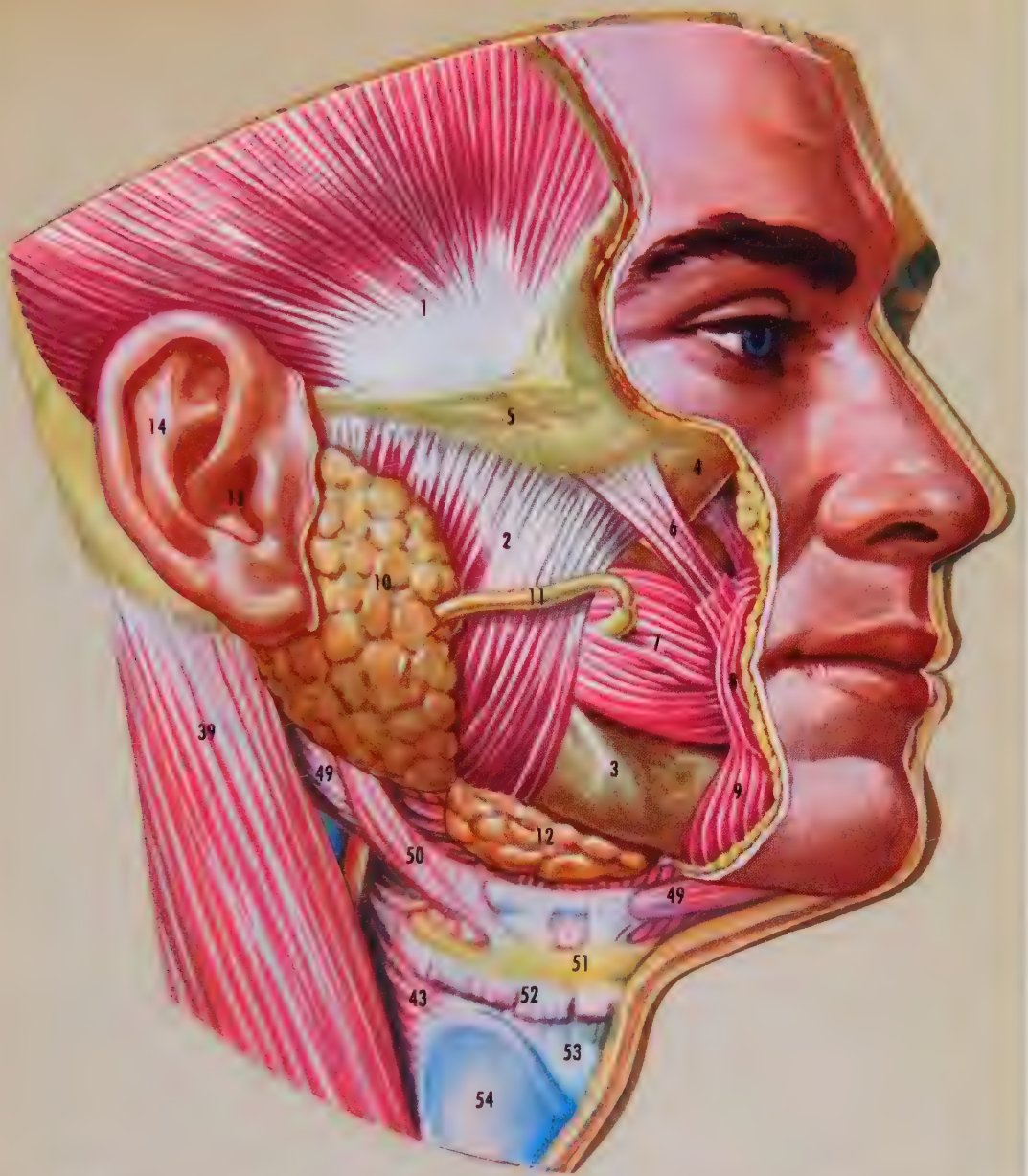
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\*Extrinsic muscles of the tongue







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**RIGHT SIDE OF HEAD AND NECK VIEWED SLIGHTLY FROM THE FRONT**

Two strong chewing muscles, the **temporal (1)** and **masseter (2)** attach to the lower jawbone, or **mandible (3)**, only bone of the skull that moves in chewing. The upper jawbone, or **maxilla (4)**, is fused with the skull. The masseter arises from the maxilla and the cheek bone, or **zygomatic arch (5)**. Around the mouth are muscles of expression. The **zygomatic (6)** raises the angle of the mouth as in mirth, and the **triangular (9)** depresses it; the **buccinator (7)** forms the side wall of the mouth. All blend with fibers of the **circular muscle (8)**, which is partly fused with the lips. The **parotid gland (10)** produces saliva which reaches the mouth through a **duct (11)**. Also visible are the **auricle (14)**, or the outer part of the ear, as well as the opening of the **external auditory meatus (15)**, or the canal that carries sound waves to the eardrum.



## II

### INSIDE OF HEAD CAVITIES: CRANIUM, ORBIT, AIR SINUS, MOUTH

The *cranial cavity* (16a, b) encloses the brain. The thick white lining is the *dura mater*. The *mandibular nerve* (17) leaves the cranium through the oval foramen at base of skull. Tear or *lacrimal glands* (21), lie in the *orbit* (20); their tiny ducts follow the *conjunctiva* (22) to open at lid margins. The *circular muscle of the eye* (23) is partly fused with the lids. The floor of the orbit forms the roof of the *maxillary sinus* (25), shown here at its widest part. Below is the mouth cavity, into which the ducts of the *salivary glands* (12, 26) enter through the mucosa under the tongue. Two more chewing muscles, the *pterygoids* (28, 29) are attached to the inside of the mandible. The *lateral pterygoid* (29) moves the jaw joint, which is formed by the articulation of the *head of the mandible* (3a) with a socket in temporal bone of skull.





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### III

#### STRUCTURES OF THE EYE, EAR, AND AIR AND FOOD PASSAGES

In the orbit are the **eyeball** (31) with its muscles, the **optic nerve** (32), and **elevator muscle** (33) of upper lid. Behind the orbit and beneath the **dura** are the branches of the **trigeminal nerve** (35). The **eardrum** (36) fits across the end of the **external auditory meatus** (15). Above it the ear bones, or **ossicles**, are exposed in the **middle ear cavity** (37). Attached to the skull's **mastoid process** (38) is the large **sternocleidomastoid muscle** (39), which turns the head sideways. Centered are **muscles of the palate** (41, 42), **pharynx** (43, 44), **tongue** (45, 46, 47), and **hyoid bone** (49, 50, 27, 52). The **hyoid bone** (51) anchors the muscles of the tongue and throat; its **lower group** (52) has been removed in order to show the **thyroid cartilage** (54). The **maxillary sinus** (25) reveals its openings into the nasal cavity.









# THE HUMAN HEAD

## In Anatomical Transparencies

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University of Halle, and the German University in Prague. While practicing in London during the 1890's, he began investigations of the transmission of sensation by the nerves, which brought him world-wide recognition. From studies which clarified the causation of herpes zoster (shingles), he was able to delineate the areas supplied by the various sensory nerve roots. Head also did important work on the cutaneous distribution of pain and tenderness in visceral disease and on disorders of sensation resulting from damage to the brain. He edited *Brain* for many years and wrote *Studies in Neurology* (2 vols. 1919) and *Aphasia and Kindred Disorders of Speech* (2 vols. 1926). Knighthood was conferred on him in 1927.

**HEAD.** In all vertebrates (Chordates) above amphioxus a distinct head region is present; or in other words, the anterior part of the nervous system becomes distended to form a specialized region, the brain, and this brain is surrounded and protected by a brain box or cranium—hence the name of Craniata, applied to all vertebrates with a head. In the higher Craniata the brain box becomes a dense bony case, the skull; but in lower forms it may be a simple trough of cartilage or gristle. The head is a segmented structure, but the skull is not. In the developing embryo the head region is first indicated by the appearance of a swelling on the anterior part of the nerve tube (medullary canal). This swelling, known as the first brain vesicle, is rapidly followed by a second and a third; and from these three vesicles the five parts of the adult vertebrate brain originate. In connection with the first vesicle appear the two optic vesicles, which are the first rudiments of the eyes and are very prominent in the early stages of development. The segmentation of the vertebrate embryo is early shown by the appearance of what are known as the mesoblastic somites, which are blocks of tissue forming the rudiments of the future muscles. The splitting of the mesoblast (see EMBRYOLOGY) into blocks also takes place in the head region, and affords one proof of the segmented nature of that region. At a later stage in development cartilages appear at the sides of the notochord in the region of the brain, and these constitute the rudiment of the future skull. In such vertebrates as reptiles, birds, and mammals there appear what are known as visceral arches, in reality the remains of the gill arches of the fishlike ancestors.

**HEAD FORM.** The shape of the head is used by anthropologists as one feature in determining RACE. Head length is measured from glabella (the most forward point on the frontal bone in the median line) to the most distant point at the back of the skull in mid line. Maximum width is measured at points on the parietal bones above the ears. From these measurements indices are set up by multiplying the width by 100 and dividing by the length. Heads having an index of 80 or more are called brachycephalic—or broadheads—those with less than 75 are known as dolichocephalic—or long heads. In general Mongoloids are brachycephalic while Negroes are dolichocephalic. See ANTHROPOLOGY; RACE, Races of Man.

FAY-COOPER COLE

**HEAD INJURY.** Although the incidence of head injuries is high, in the vast majority of cases people recover from them without serious consequences. Severe head injuries often leave permanent defects, and may cause death, and even seemingly minor injuries can result in permanently impaired function. The term head injury refers to damage of any portion of the head: soft tissues, sense organs, skull, and brain. The term is most often used, however, in connection with injury to the brain. The brain contains centers that control all the vital activities of the body; it also performs the functions of thinking, feeling, and remembering. Because damage to the brain therefore outweighs in seriousness any damage to other structures of the head, the present discussion will be limited mainly to a consideration of injury to the brain.

**Skull Fractures** are commonly regarded as very serious injuries. They frequently are, but usually their seriousness depends entirely upon how they affect the brain. Damage to the skull itself is relatively unimportant to life and health, since the bones heal readily, though injury to bones of the face may cause cosmetic defects. (see PLASTIC SURGERY). A skull fracture is most important when bone fragments press on or enter the brain (*depressed fracture*); when air (and with it, germs) can enter the intracranial cavity (*compound fracture*); or when blood vessels coursing along the inside surface of the skull are torn, causing hemorrhage, pressure, and irritation of the brain. To understand some of the effects of head injuries it is important to know something about the brain and its protective coverings. See BRAIN; CEREBROSPINAL FLUID; NERVOUS SYSTEM.

**Some Important Facts About the Brain.** The brain is covered by three thin membranes (the meninges), is surrounded by cerebrospinal fluid, and is incased in the rigid skull. Although the meninges and the fluid buffer the brain somewhat against jarring, severe blows to the skull are transmitted to the brain without much diminution, generally affecting the entire brain to some extent. Because the brain is not rigidly fixed within the skull, a blow may cause it to rebound from a blow on one side, so that the opposite side of the brain is also injured. This is called a *contrecoups injury*. The meninges are continuous over the entire surface of the central nervous system, and the cerebrospinal fluid circulates throughout the central nervous system. This is why infection that enters through a compound fracture of the skull affects not only the portion of brain in the immediate area (brain abscess) but spreads all over the central nervous system in the form of MENINGITIS. Various areas of the brain serve different functions, which explains how injuries to the brain may result in a wide variety of effects and defects. Although immediate results of brain injury are much alike in most cases, later effects vary widely and depend largely upon the area damaged.

Nerve cells, once injured, have little capacity to regenerate, and do so at all only slowly. If a nerve cell is killed no replacement of it is possible. (See NEUROLOGY.) These facts account for the slowness in recovery from brain injury, and for the fact that serious damage often leaves some permanent impairment. However, some recovery is possible for as long as two years or more following brain injury. In many cases some nerve cells are badly damaged but not killed, and these gradually become restored. Also, at least in some cases, cells in other parts of the brain may slowly take over the function of damaged ones. Just how this is accomplished is not known, except that it involves a learning process, and thus takes much time.

**Brain Concussion.** Immediately following a blow to the head a person may be dazed or unconscious. This is apparently due to a type of shock suffered by the brain tissue, and is called brain concussion. This is the condition most often found when people are "knocked out," as in boxing or after a fall. It is a very frequent form of brain injury, but one that rarely has serious consequences. Repeated injuries of this sort, however, may produce permanent effects, as in boxers who become impaired particularly in the intellectual spheres, a condition popularly known as being "punch drunk." Concussion isn't fatal. For this reason changes in the brain tissue are not exactly known, but it is evident that repeated insults of this kind produce permanent damage, particularly to cells in the frontal lobes of the brain.

**Contusion of the Brain,** which may be caused by more severe blows, is in reality a bruise of the brain, and is characterized by swelling (EDEMA) of the brain tissue, along with minute hemorrhages from the capillaries. Because of the edema severe contusions of the brain may increase the intracranial pressure, which

may cause various disturbances due to pressure on vital centers. Contusions of the brain are accompanied by unconsciousness of varying duration, from a few minutes to several days. In the recovery phase there may be manifestations of irritation of the brain, including delirium, hyperactive reflexes, restlessness, and overreaction to stimuli. Nausea and vomiting are not uncommon, and there may be associated malfunction of some of the cranial nerves, whose nuclei may be damaged. Convulsions may be present, due usually to pressure, but sometimes to damage to the motor cortex.

**Laceration of the Brain.** The brain tissue may be torn following a blow to the head, or from penetration by bone or other foreign object. Such a tear is called a laceration of the brain. Lacerations not caused by penetration of the skull are almost always accompanied by contusion, but when the skull is penetrated the brain may be torn though not bruised. For instance, a shellburst may remove a piece of skull and tear part of the brain without damaging any other portion of the brain, since it is no longer incased in a rigid shell. This is why people with severe head injuries may remain completely conscious. The effects of lacerations are much like those of contusions, though localized effects due to the tear itself are apt to be more permanent.

**Hemorrhage.** Both contusions and lacerations of the brain may result in bleeding into the cerebrospinal fluid, which can be ascertained by lumbar puncture. Extensive bleeding may irritate the meninges and surface of the brain and contribute to an increase in intracranial pressure. In some cases the blood may be confined within the meninges, forming a mass of blood much like a tumor, which presses upon the brain. Such clots of blood are called *hematomas*. Those outside the dura mater are called *extradural*, and are usually due to rupture of the middle meningeal artery in the temporo-parietal region of the skull. Those within the dura mater are called *intradural*, and may be caused by rupture of any of its blood vessels. The symptoms of hematomas are those of pressure, with some signs of localization, and usually concussion or contusion is present. After concussion there is often recovery of consciousness (a *lucid interval*) and then a return to unconsciousness. When this sequence is observed it is almost certain that a hematoma has formed, which is important because surgical intervention is usually necessary to remove the blood clot whose pressure is causing the unconsciousness.

**Later Results of Brain Injuries.** Once the dazing or unconsciousness of brain injuries has passed off other effects may become apparent. One of the most common of these is loss of memory for the accident and for a period before and after the accident. Such a loss of memory is called *AMNESIA*, and is common even in concussions. Headache is very frequent, and may last continuously for days followed by a variable period in which headaches are frequent, most often brought on by straining of some sort. When localized areas of the brain are damaged there may be any variety of symptoms, depending upon the exact area damaged. These defects include paralysis of various cranial nerves, difficulty in speech (aphasia), weakness, spasticity of muscles or muscle groups, interference with normal sensation, and other symptoms. Convulsions may occur from pressure of scars over the motor cortex. This symptom may often be relieved by surgical removal of the scar. Hematomas of moderate size may cause little trouble at first, but later on, when the blood clot is being absorbed, there may be swelling of the clot, with a resumption of symptoms. This may occur long after the injury.

Until recently many of the more minor psychological results of brain injury were not easily recognized. There is often forgetfulness, but the most prominent defect is in the sphere of *conceptual thinking*. People with this defect are unable to comprehend

abstract ideas well, and tend to speak of concrete things and to think in concrete terms. For example, one woman was unable to name abstract classes of animals but able to name specific animals in a zoo. Another woman could get from her dormitory to the dining hall if she followed the same path each time, but was unable to figure out abstractly the way there if she was taken off her path. People with this kind of defect are often jolly and tend to avoid situations that will show up their defect, so that they are often not diagnosed. Aside from this type of result from head injury, which is due to damage to the frontal lobes of the brain, there are also neurotic reactions that do not relate specifically to the injury that occurred, but which nevertheless make the individual less efficient. These are related to the personality and past experiences of the individual rather than to the injury, which in itself simply serves as one of many possible precipitating events in their illness.

ALDEN RAISBECK, M.D.

**HEADACHE, or CEPHALGIA**, is a symptom accompanying a great number of ailments, caused by organic lesions or functional disturbance not necessarily confined to the head region. The ordinary variety, as distinguished from the periodic "blind" or "sick" headache of *MIGRAINE*, is not considered a disease. Many studies have been made in an effort to discover what causes headaches and how they can be prevented and treated. Though much has been learned there remain many unsolved questions. The evidence seems to indicate, however, that headaches come from sensory impulses originating in the distended or dilated walls of intracranial blood vessels. The blood vessel changes may result from (1) variations in intracranial pressure, (2) modified composition of the blood, or (3) reflex effects from different regions of the body, particularly visceral organs. Because of the multiplicity of their causation, successful treatment of headaches depends upon the discovery and correction of the conditions responsible in each individual case.

The pain in the majority of headaches seems to be connected with the irritation of sensory nerve endings in the walls of the blood vessels either in the brain itself or in its coverings, the so-called meninges (dura mater and pia mater). This irritation may result from an increased pressure in the cranial cavity (intracranial hypertension) or from a stretching or dilatation of the vessels. Conditions that produce an increase in intracranial pressure are abscesses and tumors in the brain, and tumors in the pineal gland and hypophysis. Injection of air into the ventricles of the brain for encephalography (x-ray photography of the brain for diagnostic purposes) also increases intracranial pressure and causes headache. On the other hand, a sudden drop in intracranial pressure resulting from the withdrawal of cerebrospinal fluid by a lumbar puncture may cause a "puncture" headache. Among the local extracranial causes of headaches are inflammatory changes involving the principal sensory nerve of the face (trigeminal neuralgia), infections of the sinuses, and eyestrain.

The "congestive" origin of the pain is indicated by the fact that in susceptible persons the intravenous injection of *HISTAMINE*, which is known to produce vascular dilatation, leads to headache. Since intracranial vasodilatation can also be produced reflexly, it is to be expected that emotional experiences, as well as sensory stimulation from remote regions of the body, should produce headaches. (See *VASOMOTOR SYSTEM*.) The headache of *CONSTIPATION* disappears so promptly after a bowel movement that it cannot possibly be due to "auto-intoxication" from the circulation of poisonous substances absorbed from the intestine. It must be of reflex origin. However, it is also true that systemic poisoning, which occurs in some fevers and in kidney diseases (acute glomerulonephritis, arteriolar nephrosclerosis, uremia), is a frequent cause of headache. So are circulating drugs,



such as nitroglycerin, which is used in the treatment of angina pectoris. Conversely, a lowering of the concentration of certain normal constituents of the blood may also result in headache. For instance, the headache associated with HUNGER may be due to a decrease in blood sugar.

NATHANIEL KLEITMAN

**Headache Remedies, or Cephalalgics.** The pain in many types of headache may yield to different nonspecific pain-relieving drugs such as ASPIRIN, ACETANILID, opiates, and other ANALGESICS. The mode of action of these drugs in these conditions is exerted on the pain-perceiving centers of the brain, probably on the optic thalami. When these structures are depressed by various analgesic drugs the threshold for pain is increased. A full therapeutic dose of aspirin, for example, produces an increase in pain threshold up to 35 per cent. Opiates are still more effective. The use of ergotamine in migraine headache is another example of a symptomatic remedy (see ERGOT). Ergotamine is not a general pain-relieving drug, and, in spite of many theories attempting to explain its beneficent effect in migraine, its mechanism of action is still puzzling. The excruciating headache arising from neuralgia of the fifth cranial nerve yields to inhalation of *trichloroethylene*. This drug is a general anesthetic and it is possible that the inhalation of small amounts results merely in a nonspecific general analgesia.

Measures that relieve headache by attacking, not the symptom, but the cause, of the disease are numerous and cannot be discussed here in detail. It is obvious, however, that when headache is caused by eyestrain or disease of the eye the attention must be focused on the eye and not on the headache; infections of sinuses, of the middle ear, of the mastoids, must be treated medically or surgically before complete relief is obtained. Headache caused by liberation of histamine in the body (histaminic cephalalgia) is now

being treated successfully either by the administration of anti-histamine drugs or by the administration of gradually increasing doses of histamine, leading to "histamine desensitization."

Headache remedies are widely advertised to the general public and a large variety of proprietary drugs are being offered for self-medication. The difficulty with this practice is not that any given remedy may or may not relieve the headache, but that the temporary relief of pain will prevent many individuals from consulting competent physicians to look for the root of and to remedy the evil. THEODORE KOPPANYI

**HEAD-HUNTING**, the practice—now, however, dying out—among the DYAKS of Borneo, natives of Philippine Islands, and other Eastern tribes, of obtaining and treasuring up the heads of their enemies. Head-hunting was at one time practiced by the northern and western nations of Europe, who sometimes embalmed the heads and preserved them as heirlooms, but oftener nailed them on their houses along with the skulls and skins of beasts.

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**HEADDRESS**, a covering or ornament worn on the head. Although originally protective in purpose, the headdress soon became an important corollary of rank, sex, religion, and ritual. As early as the ancient Egyptian period, only the aristocracy was allowed to wear the symbolic sacred asp, phoenix, and other decorations as headdresses, while the common people were forced to shave their heads. The modern symbol of royal blood, the crown, was worn by people of all social ranks until the Renaissance when it was reserved for royalty only. Its prototype was the laurel wreath, a mark of honor with both the Greeks and Romans.



Toque

Wimple

Laurel



Hennin

Egyptian Queen

Indian

## VARIATIONS IN HEADDRESS

Headdresses have often signified the status of women. In central Europe a crown of horsehair, lace, and flowers worn on the head indicated an unmarried girl or a bride; matrons wore shawls or caps as head coverings. A flower worn over each ear denoted maidenhood in certain Eastern countries and different flowers were reserved for dressing the hair on special occasions.

The escoffion, wimple, and toque, medieval head-dresses which covered a woman's hair completely, were made popular by the influence of Christianity. This fashion reached its climax when women plucked and shaved their hair away from their foreheads to gain the desired bald effect. Headdresses which cover the entire hairline are still retained for the women of certain religious orders today.

Ritual has always utilized the decorative head-covering. An outstanding example is the war bonnet of the American Indian, a mixture of feathers and beads, worn only on ceremonial occasions. See BONNET; HAIRDRESSING; HAT AND HAT MANUFACTURE; WIG.

BIBLIOG.—R. T. Wilcox, *Mode in Hats and Headdress* (1945).

**HEALEY, GEORGE PETER ALEXANDER**, 1808–94, American portrait painter, was born in Boston and studied in Paris. His “Webster’s Reply to Hayne” (1851), which includes 130 portraits, is well known through reproductions; the original is in Faneuil Hall, Boston. For the Paris exhibition of 1855 he painted a picture of Franklin presenting the American colonists’ claims to Louis XVI. He also did portraits of many of the presidents of the United States (now in the Corcoran Gallery, Washington, D.C.).

**HEALING.** See WOUND.

**HEALTH.** See ANATOMY; BACTERIA, *Bacteria in Disease*; COMMUNICABLE DISEASE; DENTAL HYGIENE; DENTISTRY; DISEASE, Principles of Treatment; MEDICINE; MENTAL HYGIENE; NUTRITION; OCCUPATIONAL DISEASE AND INDUSTRIAL HYGIENE; PHARMACOLOGY; PHYSIOLOGY; PUBLIC HEALTH; VITAL STATISTICS.

**HEALTH, BILL OF.** See BILL OF HEALTH.

**HEALTH, BOARD OF**, an administrative agency of government established for the regulation of public sanitation, for the prevention of epidemics, the control of contagious diseases, and such matters. In England such a board of health was established early in the 19th century; at the present time, however, this function is under the minister of health, who has a position in the cabinet. In the United States, beginning with Massachusetts in 1869, all the states have set up departments of health. Ordinarily the state department of health is headed by a board of health with 3 to 15 members, either unsalaried or paid by the day for services rendered, usually holding meetings several times a year. Usually there is a full-time executive, called the health commissioner, director of public health, or secretary to the board of health. The department often has divisions for the different phases of its work. State health departments lay down and enforce rules for the prevention of contagious diseases, supervise sanitary conditions in hotels, tenements, and slaughterhouses, investigate health matters, keep vital statistics, promote maternal and child health, inspect the sources of milk, water, and ice, seek to protect rivers, lakes, and harbors from pollution, and may supervise and control local health officials.

Most municipalities likewise have a department of health under the control of a board of health, although some cities have the single commissioner instead. In most cities of over 25,000 population there is a salaried health officer, but usually in smaller places a physician engaged in private practice devotes part-time to public health matters.

**HEALTH CENTER**, an institution which provides, promotes and co-ordinates medical services for the residents of the community or district in which it is established. It may offer such services as control

and diagnosis of communicable and venereal diseases, clinics for infant and pre-school children (see CHILD WELFARE), advice for expectant mothers, visiting nurse programs, the dissemination of public health knowledge, medical treatment for ambulatory patients (see CLINICS AND DISPENSARIES) and social welfare aid. With so broad a program it can be seen that some hospitals, medical centers and clinics might also be termed health centers. A major distinction is that health centers, sometimes called health units, primarily are concerned with preventive rather than curative medicine.

**HEALTH EDUCATION.** Regard for health, and education for it, have come to be regarded as of first rank importance in planning and carrying out educational programs. The statement of educational goals issued by the NATIONAL EDUCATION ASSOCIATION in 1926 listed health first, and the ranking still holds in the minds of educators, who believe that good health promotes educational advancement in all lines, besides preparing for the rigors of adult life. The experience of draft boards in two world wars has indicated the need for better health and health education throughout the country.

From nursery school to university, and in adult and community groups, health education is provided. The aim is to develop proper health habits and an increasing sense of individual responsibility for one's own health, both physical and mental. In the early school years children begin to learn proper habits of eating and elimination, sleeping and resting, exercise, bathing, emotional control, care of the teeth and eyes, and wearing suitable clothes. In the middle years and in high school each child assumes greater responsibility for annual physical and dental examinations, making and keeping appointments for treatment, and in caring for his own health equipment such as glasses, toothbrushes, and clothing for inclement weather. At the higher levels the individual hears lectures and similar formal instruction in health, which he is expected to apply to his own case. At all levels, the cultivation of good health habits is stressed as the best way to prevent ill health.

Habitual use of professional and community facilities is taught. Frequently the annual medical examination is conducted in the school building. Apparatus for chest clinics is brought to the school. Psychologists are employed as consultants and in some schools as regular members of the staff. A cumulative record for each student follows him through school, to aid him in discovering the need for treatment and in carrying it as far as necessary. These facilities are usually provided through the co-operation of a school's health office and physical education departments, the municipal health office, local physicians and dentists, and institutions like those combating tuberculosis and cancer.

Regard for health education is further evidenced by the readiness of all teachers and guidance workers to report special conditions of sight, hearing, or temperament to the school health office, so that proper measures can be taken in co-operation with the parents of the individuals concerned. Another sign

### Proper diet is a part of health education

U.S.D.A.





is the provision of school lunches free or at low cost. Direct or incidental instruction in health is given in biology and other science classes, and in some places by school-wide programs in nutrition. See DENTAL HEALTH EDUCATION AND HYGIENE; FATIGUE; MENTAL HYGIENE.

R. H. CARPENTER

**HEALTH, EDUCATION, AND WELFARE, DEPARTMENT OF**, an executive department of the federal government responsible for activities in the field of social and economic welfare, health, and education and headed by a secretary who is a member of the president's cabinet. The department was created with the reorganization on April 11, 1953, of the FEDERAL SECURITY AGENCY, whose functions were transferred to the new department. Units included in the transfer were the Food and Drug Administration, the Office of Education, the Office of Vocational Rehabilitation, the Public Health Service, and the Social Security Administration. Under the provisions of the reorganization the secretary is assisted by an under secretary, two assistant secretaries, and a special assistant for health and medical matters. The position of commissioner of social security was made subject to presidential, instead of civil service, appointment.

**HEALTH INSURANCE, PRIVATE.** See INSURANCE, *Casualty*.

**HEALTH INSURANCE, STATE**, a phase of social insurance which provides medicinal services and, under some plans, compensation for loss of wages during the illness of the insured. Such state administered plans are usually compulsory (i.e., all citizens must be included) in order to protect the economically weakest as well as to secure the widest possible spread of risk.

**History and Background.** Since the INDUSTRIAL REVOLUTION various forms of health insurance have been sponsored, usually supervised by friendly societies, trades unions, or private insurance companies. The origin and development of state-controlled health insurance has been European for the most part, with responsibility for devising it attributed to the German statesman, Bismarck, who in 1883 introduced a system providing for regular contributions from both employers and employees and also from the state. By the outbreak of World War II, thirty countries had some form of state health insurance. Although some of these state plans were voluntary, the disadvantages to those who do not join are so great that the system in effect becomes compulsory.

**Objectives, Financing, and Coverage.** The objectives of health insurance plans, as with all insurance, are to provide adequate funds to meet unexpected disaster accruing to the individual, in this case illness or incapacity to work. In the United States social and economic studies show that medical knowledge increased immeasurably during the first half of the twentieth century with a concomitant increase in the cost of medical service and that this cost is beyond the income of a large proportion of families.

Most programs of public health insurance are financed by contributions from both workers and employers, with a subsidy from the state. However, under this method the worker indirectly may pay a disproportionate share. As a consumer he may be assessed a portion of the employer's contribution through increased prices, and as a taxpayer he may be paying the government's part of the bill. This latter condition is most usual if the state derives its income from sales taxes; however, if the state's share of the cost is raised by a tax levied on income, excess profits, or inheritance, the result is a drawing upon surplus wealth to aid the lower income groups.

Most forms of social insurance, especially those in the earlier years, included only wage earners. Other groups which need financial protection against sickness but which cannot easily be fitted into a payroll deduction plan include the self-employed, migratory

labor, and the unemployable. However, improvements in the administration of public insurance have made some progress toward including certain classes of the self-employed, usually at a higher premium than the worker pays. For the casual worker and certain other classes the term "medically indigent" has been coined to designate those for whom the state must furnish medical services without cost.

**In the United States.** The first national health insurance project established in the United States was the Marine Hospital for Merchant Seamen authorized by Congress in 1798 and supported by a monthly tax on each seaman. The first serious proposals to establish comprehensive plans were made by the American Association for Labor Legislation in 1915. By 1917 bills modeled after a sample law drafted by this organization were introduced into at least twelve state legislatures, while eight others appointed health insurance commissions. No legislation resulted at that time, but later Rhode Island and California adopted compulsory health insurance laws which are still in effect. The first proposal for a Federal plan appeared as part of the Social Security Act of 1935, but this provision was omitted in the final form in which the act was passed. In 1946 the Wagner-Murray-Dingell bill, providing health insurance for virtually all workers, and in 1947 the Taft-Smith-Ball-Donnell bill, providing for assistance to state medical and hospital programs, were introduced into Congress but did not come to a vote. After a year of study, the President's Commission on the Health Needs of the Nation issued in 1952 a report advocating, among other suggestions, voluntary health insurance and state health authorities with secondary federal aid. Inasmuch as American business and professions have been traditionally free from direct government supervision, such proposals have occasioned much political and public debate. See SOCIALIZED MEDICINE; SOCIAL SECURITY; PUBLIC HEALTH; GREAT BRITAIN, *National Insurance System*; INSURANCE, *Casualty Insurance*.

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**HEALTH RESORT**, a place frequented by persons who wish to preserve or recover their health through a change in climate, environment, and sometimes special treatment. From the standpoint of health resorts the earth is divided into seashore, highlands, deserts, and interior lowlands. Health resorts are situated in much the same sort of areas as are vacation resorts. The chief considerations for choosing a health resort are latitude, or the sunshine factor; altitude, the pure air factor; humidity, the dry weather factor; and facilities for comfortable living and for diversion. In contrast to the sanitarium, where medical care is the chief factor, the health resort provides the benefits which are the result of being in a restful environment.

During the winter season persons from more northerly latitudes frequent warm humid seashores such as Bermuda, Florida, California, the West Indies, the Madeira Islands, and the Canary Islands. The Mediterranean coast, southern California, and the Crimea are resort areas with a drier climate. Winter rains tend to limit their use during the winter season. The New England coast, the shores of the British Isles, and the Pacific Northwest, are frequented during the summer for the equable climate. Although they are too humid for optimum healthfulness, health seekers gain much from relaxing amid the rugged scenery. The cool pure air, intense sunlight, and the many mineral springs have made health resorts in such highland areas as the Rocky Mountains in Colorado, the Swiss Alps, the Hudson Valley slope of the Catskills, and the Saranac region of the Adirondacks. Warm dry deserts, with cool invigorating nights, a high percentage of sunshine, and low relative humidity, are found in Arizona, New Mexico, and Egypt.

Among the pollen-free areas of the world are the pine forests of the northern interior lowlands of the United States, frequented during late summer for relief from the results of allergies. Great changes in weather restrict interior lowlands from use for many ailments, as a stable temperature has been found beneficial to most treatments. See CLIMATE; CLIMATE IN THE TREATMENT OF DISEASE; SANITARIUM. E. K. A.

**HEALY, WILLIAM**, 1869–, American psychiatrist, authority on juvenile delinquency, and a pioneer in the child guidance movement in the United States. A native of Buckinghamshire, England, he was brought to the United States in childhood. He received his medical education at Harvard and the University of Chicago, taking postgraduate work in Berlin, Vienna, and London. Dr. Healy directed the first public clinic for behavior problem children, the Institute for Juvenile Research, in Chicago, from its establishment in 1909 until 1917. After that time he has directed the famous Judge Baker Foundation Clinic for child guidance in Boston. His writings include *The Individual Delinquent* (1915), and in collaboration, *Reconstructing Behavior in Youth* (1929), *New Light on Delinquency and Its Treatment* (1936), *Treatment and What Happened Afterward* (1940).

**HEARING**, a legal term which in a general sense indicates any judicial proceeding, whether in a formal litigation or not, and whether in open court or before a referee or a legislative or other commission with judicial powers. Technically the term denotes a proceeding in EQUITY corresponding to a TRIAL at law. In criminal law it is applied to the examination of the accused and his witnesses. The term, *final hearing*, is the trial of an equity case upon its merits as distinguished from the preliminary hearings which are termed *interlocutory*.

**HEARING**. See EAR; DEAF AND HARD OF HEARING; SOUND; ACOUSTICS; NOISE; LOUD-SPEAKER; AMPLIFIER.

**HEARING AID**. The modern hearing aid is a miniature public-address system. The small receiver for the ear takes the place of the loud speaker. Electronic research and the adoption of a capsule-sized vacuum tube influenced the designers of hearing aids to employ radio manufacturing methods. Present day vacuum tube hearing aids consist of a crystal (Piezo-electric) microphone, a midget amplifier, a receiver and a battery. The microphone and the amplifier are installed in the one case, and the batteries and receiver are separate units. A recent design goes further by including the batteries in the same case with the amplifier and microphone. Only one cord connects the case with the receiver.

There are two methods by which the amplified sound may reach the auditory nerve—air conduction and bone conduction. If air conduction is used, a small button-receiver is snapped on a molded earpiece and the sound energy is transmitted to the eardrum through a tube drilled in the mold. If bone conduction is used, the receiver presses against the mastoid and is held in place by a spring band over the head.

Controversy exists among the specialists regarding the precise value of "fitting" a hearing aid. At the present time, hearing aids cannot be fitted to a particular kind of deafness in a manner similar to fitting spectacles to a particular kind of visual defect. Although the technique has not been sufficiently worked out, there are some things that a physician or technician can do to help select a hearing aid for a deafened person. Among these are: (1) making and fitting a molded earpiece, (2) choosing an instrument with the best acoustical response, and (3) adjusting the response of the aid as the hearing changes.

The price range of hearing aids is considerable. The upkeep cost varies depending on the amount of time the hearing aid is in use. A list of instruments that have been accepted may be obtained from the Council on Physical Medicine of the American Medical Association.

One important contribution to the art of fitting hearing aids is auricular training. Auricular training means that the hard of hearing person is taught how to use the instrument both mechanically and psychologically. For example, he is given instruction on how to locate sounds; how to interpret the sounds which are heard in the instrument; and how to make use of sight in assisting and comprehending speech. The use of sight to understand speech is known as lip reading. Persons who are becoming hard of hearing should immediately practice this art and learn the fundamentals of it. Lip reading supplements the hearing aid and the art will greatly assist a hard of hearing person to use his instrument. HOWARD A. CARTER

**HEARN, LAFCADIO**, 1850–1904, American author, was born in Leucadia, one of the Greek Ionian Isles. His father was Irish and his mother was Greek. In his background were artistic and Bohemian traditions, and Hearn was early attracted by the exotic. He was casually educated, for a time attending Catholic colleges in England and France. He came to New York in 1869 and first made his living by menial jobs, later by writing for newspapers. For the *Cincinnati Enquirer* (1873–75) and *Commercial* (1876–77) and the *New Orleans Item* (1878–81) and *Times-Democrat* (1881–87), he wrote lurid reports of crime and political corruption and feature stories and articles remarkable for their literary quality. A collection of his newspaper articles on folklore and exotic literature was published as *Stray Leaves from Strange Literatures* (1884). *Two Years in the West Indies* (1890) recorded a sojourn in Martinique. In 1891 he went to Japan as a correspondent and quit his job to remain in Japan for the rest of his life. He became a Japanese citizen, took the name of Yakumo Koizumi, and adopted the Buddhist religion. During his first years in Japan, he taught school at Matsue and Kumamoto. From 1894 to 1903 he was professor of English literature at the Imperial University of Tokyo. Among his works of this period were *Glimpses of Unfamiliar Japan* (1894), *Out of the East* (1895), *Shadowings* (1900), *Kotto* (1902), and *Japan, An Attempt at Interpretation* (1904). His Japanese sketches, for which he is best known, give a highly romanticized picture of the country but exhibit at their best the lyric prose and skill at depicting nuances of mood which were his greatest talents. J. J. M.

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**HEARNE, SAMUEL**, 1745–92, Canadian explorer, was born in London and when 11 joined the Royal Navy. Employed by the HUDSON'S BAY COMPANY, he went to Fort Prince of Wales on the Churchill River and headed expeditions into the interior (1769–72). He was the first white man to cross overland from Hudson Bay to the Arctic Ocean, arriving at the mouth of the Coppermine River. In 1774 he built Cumberland House, the first inland post of the company. Appointed governor of Fort Prince of Wales, he was captured there by the French (1782) and taken to France. He spent his last years in England, writing *Journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean* (1795; ed. 1911).

**HEARSAY EVIDENCE**. See EVIDENCE.

**HEARST, GEORGE**, 1820–91, American mine operator, was born in Franklin County, Mo., and went to California in 1850. He made a fortune through the buying and operating of mines in several western states and Mexico, becoming one of the country's best geologists. He served in the U.S. Senate (1886–91). In 1880 he bought the *San Francisco Examiner* and in 1887 he put his son, WILLIAM RANDOLPH HEARST, in charge of it.

**HEARST, WILLIAM RANDOLPH**, 1863–1951, American editor and publisher, was born in San Francisco. He was educated at Harvard University, where he first demonstrated his journalistic ability by making the *Lampoon*, the school's humor magazine, show a profit for the first time in its history. In 1887



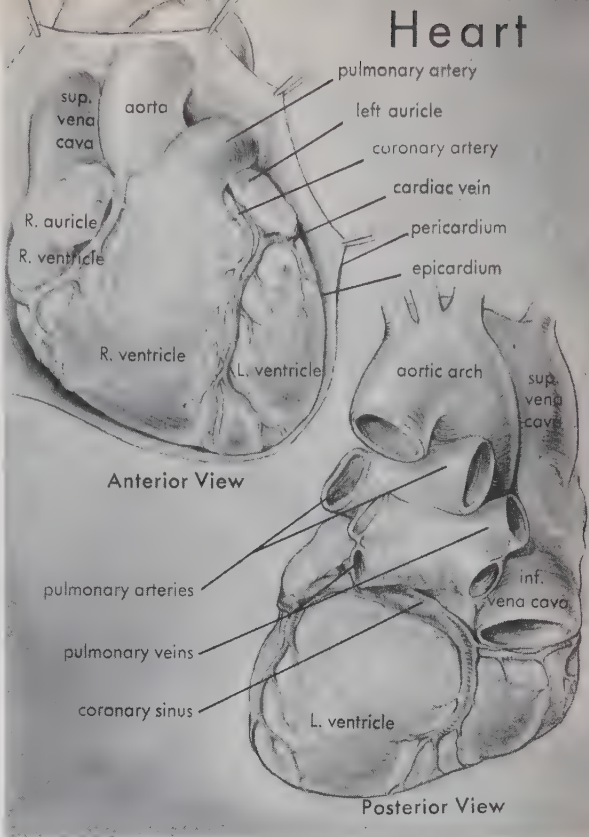
## Heart

he became the owner of the *San Francisco Examiner* and shortly thereafter began his first crusade for reform, successfully campaigning against a corrupt city charter. In 1895 he entered the New York newspaper field with the purchase of the *Journal*. During the next year he sided with Bryan for the presidency. Although he lost most of his advertising for the duration of the campaign, the circulation of his newspapers rose to record heights. Subsequently he was active in politics in addition to managing his chain of newspapers and magazines. He served in the United States House of Representatives from 1903 to 1907 as a Democrat from New York. In 1905 and 1909 he ran unsuccessfully as independent candidate for mayor of New York City and lost the campaign for governor of the state of New York to Charles Evans Hughes in 1906. The unprecedented popularity of the *New York Evening Journal* moved him to expand his newspaper holdings. In 1900 he established the *Chicago American*, in 1902 the *Chicago Examiner*, and in 1904 the *Boston American*. Further expansion brought him control of major city newspapers in every section of the country. This was followed by an invasion of the magazine publishing field and he became the owner of many popular magazines, including the *International-Cosmopolitan*, *Good Housekeeping*, *Harper's Bazaar*, *Town and Country*, and *House Beautiful*. During the 1930's he also acquired a large number of radio stations. After 1939 he assumed the responsibility for writing a daily column called "In the News," in which he commented on domestic and international affairs.

S. W. X.

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## Heart



## THE HEART ❖ Pump Composed of Unique Muscle

*This four-chambered organ is a double pump, the right one sending to the lungs blood received from the body, the left one sending to the body blood returned from the lungs*

**HEART.** The heart is a muscular circulating pump that supplies energy to keep the blood moving through the capillaries. Organisms provided with a circulatory system usually have a relatively small amount of blood. This continuously gives up oxygen and food substances to the tissues and carries away carbon dioxide and other metabolic end products. Life can continue only if the composition of the blood is kept constant by circulation through the organs that replenish its expendable constituents and rid it of its wastes. So small is the reserve of oxygen contained in the blood and tissues that when the heart stops life goes out, in higher animals in a matter of minutes. See BLOOD; CIRCULATION; ARTERIES, VEINS, AND CAPILLARIES.

In its principle of operation the heart may be likened to the familiar rubber bulb syringe, or atomizer, provided with valves to ensure flow in one direction only. Whereas the rubber bulb is operated by outside pressure, the hollow muscular heart exerts tension on its contents by the shortening and thickening of its fibers. The heart's emptying into arteries and its refilling from veins depend upon the property of *rhythmicity*, an alternation of *systole* (contraction) and *diastole* (relaxation) of its musculature.

Though the anatomical arrangements of its parts suggest the function of the heart, it was not till early in the 17th century that WILLIAM HARVEY proved that the blood passes through the heart in one direction only, instead of eddying back and forth in the veins, as was thought up to this time. He showed that a frog's heart will shrink when its venous connections are tied off, will swell when the aorta is blocked. Studying the arrangement of the valves of the heart, he also concluded that blood must flow in a circle through it.

**Vertebrate Hearts.** In fishes the heart is a two-chambered organ, the blood from the veins entering through a sinus into the *atrium*, or forechamber, thence passing into the ventricle ("little belly") that pumps it into the aorta, the principal artery. Of the two chambers the ventricle is always the more powerful pump; the pressure it generates suffices to push the blood through two successive capillary beds—the first one in the gills, where oxygen and carbon dioxide are exchanged, the second one in the body as a whole.

In amphibia, with the appearance of lungs, the heart acquires a second atrium. In this three-chambered organ the right atrium receives blood from the systemic veins via the *sinus venosus*, and the left fills from the pulmonary veins. Although both atria discharge their contents into the single ventricle, the venous and arterial bloods do not get mixed; they flow side by side, but the anatomical arrangements are such that the brain gets more of the arterial blood, the lungs more of the venous blood, and the rest of the organs varying proportions of each.

In reptiles, birds, and mammals the heart acquires a second ventricle. This four-chambered heart is really a double pump composed of a *right heart*, which receives blood from the body via the systemic veins and circulates it through the lungs, and a *left heart*, which receives blood from the lungs and distributes it via the systemic arteries throughout the body. The left ventricle must generate much higher pressures than the right, and has correspondingly thicker walls. Otherwise the two pumps are alike, and operate in almost complete synchrony except that the beat originates in the right heart.

The human heart, as in other mammals, is roughly conical in shape, with its base toward the head. It

is 4-5 in. long, 3-3½ in. wide, and 2-2½ in. thick at the base, weighing 10-13 oz. in the male and 8-10 oz. in the female. It lies between the lungs somewhat asymmetrically, so that its apex is quite to the left of the midline of the chest. The heart is encased in a double-layered sac of serous membrane (see BODY CAVITY) called *pericardium* (Greek for heart is "kardia"). The inner layer (visceral pericardium) adheres to the heart and is called the *epicardium*. Normally this is separated from the outer layer, the parietal pericardium, only by a thin film of lubricating fluid. The wall of the heart is composed of three layers. The outer layer is the thin *epicardium*; below this is the thick layer of *myocardium* composed of heart (cardiac) muscle; the inner layer is the thin *endocardium*, which lines the chambers of the heart and is continuous with the endothelium lining the blood vessels. See ENDOCARDITIS.

**Right Heart.** Blood returning from the body is carried by the superior and inferior venae cavae, which open into the right atrium. This is a thin-walled sac consisting of a main cavity and an appendix called the *auricle* because it resembles a dog's ear. (Sometimes the term *auricle* is applied to the entire atrium.) There is no valve at the entrance of the superior vena cava, but at the inferior there is a flap-like barrier that discourages, though it doesn't prevent, a backflow of blood. The absence of efficient valves at the venous orifices is of itself sufficient to make the atrium a poor pumping structure. Between the atrium and the ventricle there are three connective tissue "gates" forming the *tricuspid auriculo-ventricular* (A-V) *valve*. These are easily pushed against the ventricular wall and offer no obstacle to the flow of blood from the atrium. The exit from the ventricle into the pulmonary artery is guarded by three pocket-type *semilunar valves*, which, though permitting free flow of blood from the ventricle, prevent a backflow into it by filling, and thus approximating their edges. The ventricle therefore constitutes an efficient pumping mechanism, "competent" valves ensuring a unidirectional flow. The wall of the ventricle is much thicker than that of the atrium.

**Left Heart.** The left atrium, receiving blood from the four pulmonary veins, is a little smaller and more muscular than the right. The A-V valve is like the one in the right heart except that it is made up of two flaps and is known as the *bicuspid valve* (sometimes as the *mitral valve* because it looks somewhat like a bishop's hat). The real difference on the left side is in the ventricle, whose walls are three times thicker than those of the right (the partition between the two ventricles is like the outer wall of the left). The *semilunar valves* in the aorta are like those in the pulmonary artery.

**Blood Supply of the Heart.** Like all other cells in the body, those of the heart muscle must be supplied with fresh blood by capillaries penetrating the tissue. Capillaries in the heart muscle receive blood from the coronary arteries, which branch from the aorta just beyond the semilunar valves and encircle the heart like a crown (see CORONARY DISEASE). Blood from these capillaries is returned in cardiac veins that accompany the arteries and enter the coronary sinus, which opens into the right atrium.

**Heart Muscle Responds as a Unit.** Heart muscle is composed of fibers the like of which are found in no other organ (see MUSCLE AND MUSCULAR CONTRACTION). Their microscopic appearance in certain respects resembles that of the fibers of both other types of muscle; like fibers of smooth (visceral, involuntary) muscle each has a single nucleus centrally placed, and like fibers of striated (skeletal, voluntary) muscle they have cross striations. But unlike either smooth or striated muscle, in heart muscle the fibers are arranged in short, branching cylinders that seem to anastomose with each other, forming a type of tissue called a *syncytium*. This interconnection is responsible for the characteristic ability of cardiac

muscle to conduct excitation from fiber to fiber, obeying, as a mass, the *all-or-none law*, which states that a stimulus strong enough to excite one fiber will excite all of them. In skeletal muscle, on the contrary, one can demonstrate a gradual involvement of a greater number of fibers as the stimulus increases in intensity. The all-or-none law is not to be construed as signifying that the contractions of heart muscle are always the same. The contractions do differ, but it is the condition of the muscle itself, not the intensity of the stimulus, that causes the variation.

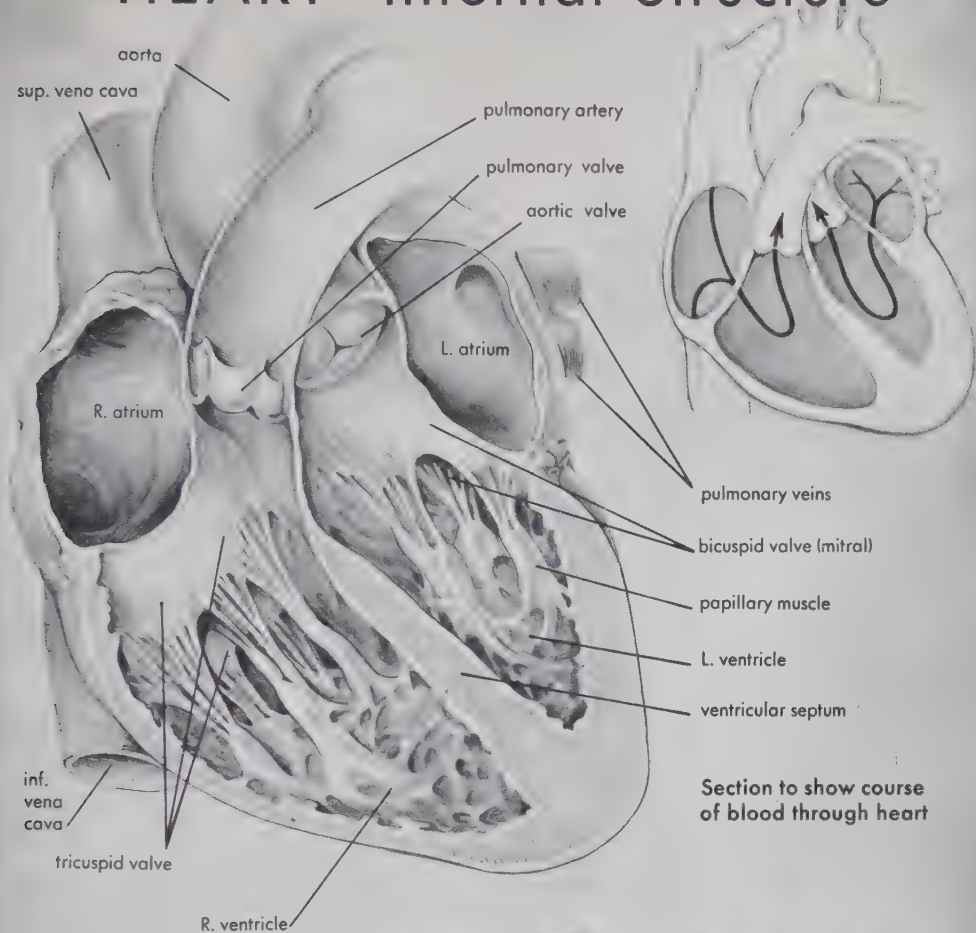
**The Heart Beats Automatically.** Another characteristic of heart muscle is its automaticity. If the heart is removed from the body and perfused with a fluid that will keep it supplied with oxygen and nourishment and remove its waste products, it will continue to beat for a long time. So will pieces of the heart similarly treated. Two theories have been proposed to explain this. According to the *neurogenic theory*, the automaticity of the heart is a property of the nerve cells imbedded in the heart muscle. According to the *myogenic theory*, which most authorities now favor, it is a property of the heart muscle itself. Whichever interpretation is correct, the automatic beating of the heart seems to be dependent on the presence, in definite proportions, of certain metallic ions in the blood or in the solution used to bathe the heart after removal from the body. Ringer's solution, in which the heart will continue to beat, is made up of sodium chloride and small amounts of potassium and calcium in the same proportions as are found in blood. If any one of these three ions is omitted from the solution, or is added in an increased amount, the heart will soon stop beating. See CARREL, ALEXIS.

**The Heart Beats Rhythmically.** The rhythmical periodicity of the cardiac cycle is fundamentally an expression of the physiological properties of heart muscle. Heart muscle is characterized by an unusually long period during which it does not respond to stimulation. Called the *refractory period*, this occurs during the entire systole, or shortening phase of the cycle. This means that, unlike skeletal muscle, heart muscle cannot be thrown into tetany (sustained contraction) by a succession of rapidly repeated stimuli. When artificially excited during diastole, the heart will execute a premature contraction called an *extrasystole*, but this is followed by a compensatory pause lasting until the heart would begin to contract, had there been an ordinary cycle without an extrasystole. This suggests the existence of a pacemaker responsible for maintaining the rhythmicity of the heart.

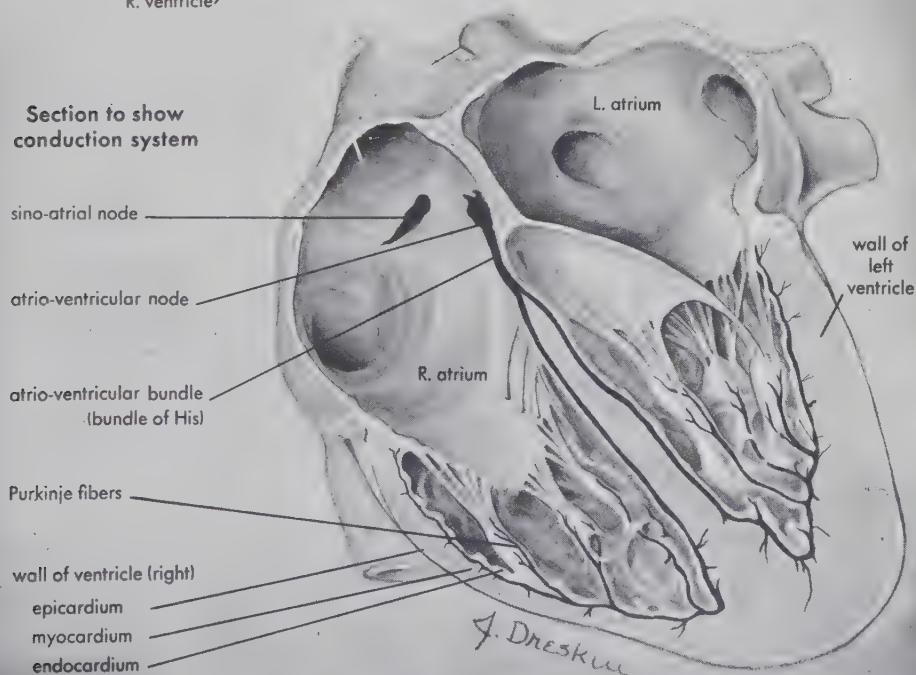
**Pacemaker of the Heart.** Between the openings of the two venae cavae there is a cellular mass known as the *sino-atrial* (S-A) *node*, a vestige of the venous sinus and still the site of origin of the heart beat. A similar mass, the *atrio-ventricular* (A-V) *node*, is located in the wall separating the two atria. Through a modified band of heart tissue called the *atrio-ventricular bundle* (bundle of His), the A-V node transmits excitation to the two ventricles. The terminal branches of this conducting system pervading the ventricular walls are called *Purkinje fibers*. That the S-A node is the pacemaker can be demonstrated by a simple experiment. It is known that the heart rate varies according to temperature, beating faster at higher temperatures (as in fever) and slower at lower temperatures. The same variations in heart rate can be induced by warming or chilling merely the small region of the S-A node, but not by similarly varying the temperature of any other region of the heart comparable in size. The pacemaker is also affected by changes in the chemical composition of the blood, and by nerve impulses reaching it via the autonomic nervous system—via the heart's extrinsic innervation (nerve fibers conducting impulses to the heart). Thus, though the heart is essentially automatic, its activity is continually modified through humoral (in part hormonal) and reflex influences, in response to the organism's needs for varying volumes of circulation.



# HEART—Internal Structure



## Section to show conduction system



**Reflex Nervous Control of the Heart.** The extrinsic innervation of the heart is often cited as an example of the manner in which the AUTONOMIC NERVOUS SYSTEM regulates, though it does not initiate, the activities of "automatic" visceral organs. These organs usually receive a double innervation, one from the sympathetic, the other from the parasympathetic. The two innervations appear to be antagonistic: where one increases the rate or magnitude of activity, the other decreases it. For the heart, the sympathetic is acceleratory and augmentatory, the vagus (parasympathetic), inhibitory. For the stomach and intestine, it is the other way around. Physiologically speaking, however, the two innervations are not antagonistic but synergistic: they work together rather than against each other. This means, for example, that a speeding up of the heart is accomplished by a simultaneous increase in the number of acceleratory impulses sent to it via the sympathetic nerves and a decrease in the number of inhibitory impulses sent to it through the vagus nerves.

Stability (homeostasis) of the pumping action of the heart is maintained by special reflexes. When too much blood is being pumped into the arterial system, the resulting distention of the arterial walls sets up excitation in stretch receptors strategically placed in the arch of the aorta and the carotid sinuses, and the heart rate is reflexly lowered. (See BLOOD PRESSURE; CAROTID ARTERY.) If the heart pumps less than the usual volume, the blood tends to accumulate in and stretch the walls of the large veins and the right auricle. Stimulation in this case leads to a reflex speeding up of the heart (Bainbridge reflex). By this "governor" mechanism, the heart, though automatic in its rhythmicity, is kept on an even level of performance, overdistention on either the arterial or venous side being promptly corrected.

By and large, high blood pressure leads to slowing, and low blood pressure to acceleration, of the heart rate. However, under conditions of stress, the sympathetic system increases its influence to such an extent that the homeostatic mechanism is completely upset. Both the heart rate and the blood pressure are increased, and several times the usual quantity of blood is delivered to the oxygen-starved musculature of the body.

**Cardiac Cycle and Heart Sounds.** During each beat of the heart there occurs a series of events called the cardiac cycle. Atrial systole spreads from the S-A node over the two atria, causing them to squeeze some of their contents into the ventricles. At this time the ventricles are already filled with blood that flowed into them through the A-V valves during the latter part of the ventricular diastole and the ensuing short pause. Backflow into the veins produces a wave of distention known as the *venous pulse*. Atrial systole lasts about one-eighth of the cycle. At its end, the ventricles, excited via the A-V node and A-V bundle, begin to contract. The first effect of the rising tension is to close the A-V valves. The semilunar valves have been shut since the beginning of the preceding ventricular diastole, so that this tension is exerted on an imprisoned volume of blood in each ventricle. Because blood, like other liquids, is practically incompressible, the cardiac muscle fibers are unable to shorten; for this reason this part of the ventricular systole is called the *isometric phase*. The *first heart sound*, of low pitch and long duration, occurs during this period. It has been ascribed variously to the closure of the A-V valves and to the contraction of ventricular muscle.

The isometric contraction continues until the increasing pressure in each ventricle overtakes the continuously falling pressure in the corresponding artery, when the semilunar valves are pushed open from within. Blood begins to leave the ventricles, distending the arterial walls and increasing sharply the arterial blood pressure. Ventricular systole lasts about three-eighths of the cycle. As soon as ventricular diastole begins and the intraventricular pressure starts to fall,

the rushing back of the blood from the distended arteries fills the semilunar valves and causes them to shut with a snap. This produces the sharp *second heart sound*, of high pitch and short duration. Diastole and then pause of the ventricles lower the pressure within them to such an extent that the blood, which ever since the beginning of atrial diastole has been accumulating in the atria and the veins opening into them, pushes the nonresisting A-V valves into the ventricular cavities, and ventricular filling is under way. At the discharge of excitation from the pacemaker a new atrial systole starts the next cardiac cycle.

**The Electrocardiogram** is a record of the variations in the electrical potential of the base of the heart in relation to its apex during recurring cardiac cycles (see ELECTROCARDIOGRAPH). All phenomena of excitability have this electrical aspect, which is called the action potential. The potential differences can be led off either directly from the heart or from the surface of the body. In the human subject three pairs of leads (from right and left arms, right arm and left leg, and left arm and leg), each pair representing changes at the base and apex of the heart, respectively, yield somewhat different electrocardiograms. These records are used to diagnose abnormalities of cardiac function, their interpretation resting on purely empirical grounds. By experience it has been found that a certain electrocardiogram is pathognomonic or indicative of a particular heart condition.

**Physiological Variations in Cardiac Rate and Output.** Among the fixed variations in heart rate are those connected with size, age, and sex. Larger animals have a slower pulse than do smaller ones, the classic examples being the canary, with a heart rate of about 1000 per minute, and the elephant, with one of 25 per minute. Even in the same species the heart rate is slower in larger individuals. Larger animals, having less surface in relation to body volume, have lower metabolic rates per unit of protoplasmic mass, and hence a slower heart rate (see BASAL METABOLISM; BODY TEMPERATURE). The same relationships apply to age. As they grow, animals and persons show a gradually slower heart beat and a lower rate of basal metabolism. Men, however, even though their metabolic rate is higher, have a lower pulse rate than do women. At birth the pulse rate of boys is about 130, of girls about 145. Because girls are more advanced for their chronological age than are boys, and because the heart rate decreases with age, there is a period (about the age of three years) when boys' hearts actually beat faster. At all ages the heart rate is very labile; it is influenced by so many internal and external conditions that attempts to establish precise rates are futile. The frequently cited figures of 70-75 for women and 65-70 for men are largely meaningless.

Muscular exercise may raise the heart rate as high as 180-200 per minute, less than this in trained athletes, whose resting rates are sometimes as low as 50-60. Muscular activity also increases the strength of the cardiac contractions and therefore the *stroke volume* of the heart. In a healthy individual at rest, each ventricle ejects 50-70 cc. of blood at each beat, but during exercise the stroke volume may rise to 100-200 cc. The *minute volume* of the circulation, which is calculated by multiplying the heart rate by the stroke volume, usually amounts to 3-6 liters of blood per minute. Training raises the minute volume at rest, the bigger stroke volume more than making up for the lower heart rate. While exercising, a trained athlete may increase the minute volume to 20, 30, even 35 liters per minute. With a total blood volume of about 5 liters, this means a complete turnover of the blood in a few seconds. The ability to make rapid adjustments to the tremendous demands for more oxygen (sometimes supplying 4000 cc. per minute compared to 300-350 cc. at rest) is what distinguishes the trained from the untrained per-



former. Hypertrophy (overgrowth) of the cardiac muscle resulting from repeated strenuous exercise leads to development of an "athletic" heart, but there is no evidence that such a heart is more subject to "decompensation" nor that its owner is more likely to have a shortened life. Among the many other physiological states that affect the heart rate and/or the stroke output, and therefore the minute volume, are posture, emotional excitement, digestion, sleep, and variations in oxygen and carbon dioxide content of the air.

**Some Pathological States That Influence the Heart.** Hyperthyroidism is usually accompanied by *tachycardia*, a fast beating heart, the increase in rate following the rise in basal metabolism; myxedema, or hypothyroidism, leads to a slowing of the heart, or *bradycardia*. In anemia the minute volume is increased, in postoperative shock it is decreased. In arterial hypertension (high blood pressure) the minute volume may be increased, decreased, or remain unchanged. Cardiac irregularities sometimes play havoc with the minute volume. Since ventricular filling must occur during diastole and pause, too high a rate may actually cause a decrease, instead of an increase, in the volume of blood pumped. Thus in one case of paroxysmal tachycardia the heart rate before the attack was 64 per minute and the minute volume about 5 liters, giving an output per stroke of 78 cc. During the attack the heart rate shot up to 198, but the minute volume fell to 2.5 liters, giving an output per stroke of only 13 cc.

*Heart block* is due to a failure of the A-V conducting system. The ventricles then beat by virtue of their own rhythmicity, instead of following the pacemaker, and the pumping rate may fall to 35–40 per minute. Although this low rate is compensated for by an increased stroke output, adjustments of rate and force of stroke to exercise, which operate on the pacemaker, cannot affect the ventricles, and the individual is greatly handicapped. Similar deficiencies in the performance of the heart, at rest and in activity, result from valvular insufficiencies, degenerative changes in heart muscle, and coronary occlusions.

NATHANIEL KLEITMAN

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**HEARTBURN**, a burning sensation which seems to come from the region of the heart, but which actually originates in the lower end of the esophagus. It is caused by the regurgitation of small amounts of gastric juice from the stomach. See **DYSPEPSIA**.

**HEARTH, OPEN.** See **OPEN HEARTH PROCESS**; **STEEL**.

**HEARTS**, a popular card game played by any number from three to twelve in which skill is used to avoid taking tricks containing any hearts, the queen of spades and, sometimes, another designated card. There are a dozen variations of the game, the most popular being Black Lady and Omnibus Hearts, the former also called Slippery Anne, Black Maria, or Discard Hearts.

Generally, each heart taken counts one against a player and the queen of spades 13. The jack of diamonds or some other designated card, may be used as a bonus card, counting 10 for the winner of the trick. The cards are dealt one at a time until all have the same number. Two decks may be used and shuffled as one where the number of players require it. To deal equal numbers of cards certain deuces and treys may be discarded to equalize the hands. In play with two packs the high card first played wins over an equal card played later in the trick. In one variation, just after the deal, each player passes three cards to his neighbor on the right but before picking up his three from the left. The object

is to rid his hand of spades from the queen up, or danger cards that are likely to pick up heart tricks.

The eldest hand leads first and the suit must be followed when possible. High card of the suit wins the trick and the winner leads to the next. In Omnibus Hearts, where the 10 of diamonds is a 10 point credit card, the four top diamonds are good cards to hold. The scoring then at the end of the hand is: each heart, -1; queen of spades, -13; ten of diamonds, +10; but by winning all 15 of the scoring cards a +26. There are so many variations in Hearts, with differences in play strategy and scoring, that the details are best found in Hoyle. V. L. S.

**HEAT.** The words "hot" and "cold" usually regard physical sensation as the means of comparison; but our senses alone cannot provide any exact comparison in the degrees of hotness. Experience shows that when a hot and a cold body are placed together, the hot body cools, and the cold body grows warm. This transference of heat from the one body to the other will go on until the two bodies come to the same degree of hotness. It is well known that the blade of a knife, under ordinary circumstances, feels colder than the handle; yet there is a heat balance between them. The introduction of the scientific term *temperature* is needed to express the relative condition of bodies as regards the transference of heat from one to the other. Temperatures indicate sensible heat changes. When bodies are at the same temperature, there is no transfer of heat from one to the other. On the other hand, there must be a difference of temperature, when there is a transfer of heat, the heat passing from the body at the higher temperature to the body at the lower temperature.

To determine which of two bodies is hotter some method is needed to indicate whether a substance is losing or gaining heat. For this purpose some measurable physical quality such as expansion under heat is commonly made use of. Practically it is the increase of volume in mercury that measures rise of temperature. A thermometer is any instrument which indicates change of temperature by the measured change of some physical quality.

When we place an ordinary mercurial THERMOMETER in contact with a particular body, the column of mercury will rise or fall according as the mercury is absorbing or emitting heat. Column heights, or volume, of the mercury correspond to definite temperatures.

**Latent Heat.** A thermometer in a mixture of ice and water remains at freezing temperature until the ice is wholly melted and will begin to rise only when heat is supplied to the water from without. Because the heat which melts the ice is hidden, not registered by the thermometer, it is called latent heat of fusion. Thus heat does not always produce "warmth." Steam from water boiling at a given atmospheric pressure has always the same temperature—that of the boiling water. The application of more heat to this boiling water will produce no rise of temperature. This unregistered heat is called the latent heat of vaporization. The water freezing temperature and the water boiling temperature form convenient standard temperatures on which to base a scientific thermometric scale, 0° centigrade and 100° centigrade.

**Change of State.** Heat is used up in changing a solid into a liquid and the liquid into a gas. These states of a substance differ from one another in the degree of constraint of the molecules which compose the substance. One effect of heat is to overcome intermolecular forces to do work. The molecules in a gaseous state have greater energy of motion than when in the liquid state and these, again, have greater energy than when they are in the constrained solid state. To melt one pound of ice at freezing temperature to water at freezing temperature requires 144 British thermal units (the latent heat of fusion). To raise the temperature of the pound of water 1° Fahrenheit requires only 1 Btu (sensible heat). To

boil away the pound of water at standard atmospheric pressure requires 970 Btu (the latent heat of vaporization).

**Combustion.** The most familiar method of producing heat is by combustion, burning, a process which involves chemical action, rapid oxidation, with the formation of new substances. Here there is a change in the molecular constitution of the matter, and what previously existed as potential energy in the substances is largely changed into heat.

Work may produce heat by friction or concussion. Work done in overcoming friction, or energy of the motion lost by the impact of one body on another reappears as heat. A delicate thermometer will register a rise in temperature of two pieces of wood rubbed briskly together. This principle was used by primitive peoples to start fires. The spark produced by the impact of flint and steel gives evidence of the generation of heat. Any rapidly moving body brought quickly to rest produces heat. A meteor becomes visible when it enters the earth's atmosphere and the atmospheric friction generates heat, in all but rare instances sufficient to consume the meteor. Whenever mechanical energy is lost to a system, heat is produced; and there is a definite relation between the mechanical energy lost and the heat produced. Joule proved that the amount of heat required to raise a pound of water 1° F. in temperature (1 Btu) was equivalent to 778 foot-pounds of work. This number is called **JOULE's dynamical equivalent of heat.**

**Loss of Energy.** Mechanical energy may be translated into heat. To reverse the process and change a given supply of heat into equivalent mechanical work is impossible. Work to be got from heat requires two bodies at different temperatures. Heat must pass from the body at the higher temperature to the body at the lower temperature. An efficient steam engine is provided with a boiler and a condenser at different temperatures. In the best possible engine some of the heat supplied by the boiler carries through to the condenser; hence, only a part of the heat supplied is available for transformation into useful mechanical work. This fact led Lord **KELVIN** to his definition of an absolute temperature scale, depending only upon energy relations, quite independent of the properties of any special thermometric substance, such as mercury, etc. When as much work as is theoretically possible is being obtained from a heat engine working between given temperatures of boiler and condenser, the temperatures of these bodies are defined to be in the ratio of the heat given up in the boiler to the heat taken in by the condenser during any complete cycle of operations. The theory indicates an absolute absence of heat at the condenser if all the heat supplied is transformed into mechanical work. This absolute zero is  $-459^{\circ}$  on the Fahrenheit scale, or  $-273^{\circ}$  on the centigrade scale. This would, of course, be  $671^{\circ}$  Fahrenheit and  $373^{\circ}$  centigrade below the boiling point of water.

This absolute scale agrees very well with the scale constructed upon the law of expansion of air, oxygen, hydrogen, etc. Thus 459 cubic inches of dry air, at  $0^{\circ}$  F. and at a given pressure become approximately 671 cubic inches when the temperature is raised to the boiling point, the pressure being kept constant. By adding  $469^{\circ}$  to the Fahrenheit measure of temperature, or by adding  $273^{\circ}$  to the centigrade measure of temperature, the equivalent number on the absolute scale is obtained. Let  $T$  be this absolute temperature, and let  $P$  and  $V$  be the pressure and volume

of a mass of gas. Then we find that the ratio  $\frac{PV}{T}$  is approximately the same whatever be the individual values of  $P$ ,  $V$ , and  $T$ . These units must conform to the system used, English or metric. Each gas or compound of gases has its coefficient, usually called  $R$  (53.35 for dry air). Thus  $P \times V = R \times T$  is used for a unit mass. If 2,116 lbs. per sq. ft. is taken as atmospheric pressure, and the absolute temperature

529 degrees on the Fahrenheit scale the volume will be found to be 13.3 cubic feet per pound.

**Radiant Heat.** Heat is propagated through a surrounding medium by waves. This implies that the particles of the radiating solid are themselves in a state of vibration. The same applied to hot liquids and hot gases.

**Conduction.** The foregoing tends to show that rise of temperature is associated with increased energy of vibration of the molecules which constitute the substance. That heat is the energy of molecular vibrations. Every molecular group is in a state of agitation, and is capable of communicating similar motions to neighboring groups. This is the process by which heat is conducted through a substance. When a particular group is passing on to contiguous groups as much energy on the average as it is receiving from these groups, there is thermal equilibrium and all are at the same temperature.

The tendency of heat is to pass from the body at the higher temperature to the body at the lower temperature; and there is no material known which is able to act as a perfect insulation or nonconductor. Thus, it is impossible for a region to remain indefinitely at a higher or a lower temperature than surrounding regions. Herein lies the great difficulty of obtaining either a very hot or a very cold body.

**Cooling by Evaporation.** Evaporation is transformation of liquid to vapor, in which form the molecules have a greater energy of motion. When water evaporates at summer temperature, as it might from sidewalks after a shower of rain, every pound of water absorbs about 1,060 Btu from the surrounding air and the sidewalk. A wet cotton bathing suit which holds considerable moisture compared to one of wool, becomes a chilling companion when one leaves the pool.

**Cooling by Expansion.** When a gas is made to expand suddenly, the work done by the expanding gas requires an absorption of energy. The gas itself loses energy in the form of heat, and the temperature falls. In recent years temperatures low enough for the liquefaction of air, oxygen, and hydrogen have been obtained. The same principle is used in freezing mixtures: A physical state is induced which requires absorption of energy, and this is accomplished at the expense of heat in the substances forming the mixture. See **THERMODYNAMICS; AIR CONDITIONING; REFRIGERATION.**

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**HEAT CRAMPS, HEAT EXHAUSTION.** See **HEAT STROKE.**

**HEAT LIGHTNING** is seen at night in a clear, or relatively clear sky when the atmospheric haze or dust reflects the glow of lightning from storms below the horizon or too remote for thunder to be audible. It is characteristic of hot weather and scattered local thundershowers. See **LIGHTNING; THUNDERSTORM.**

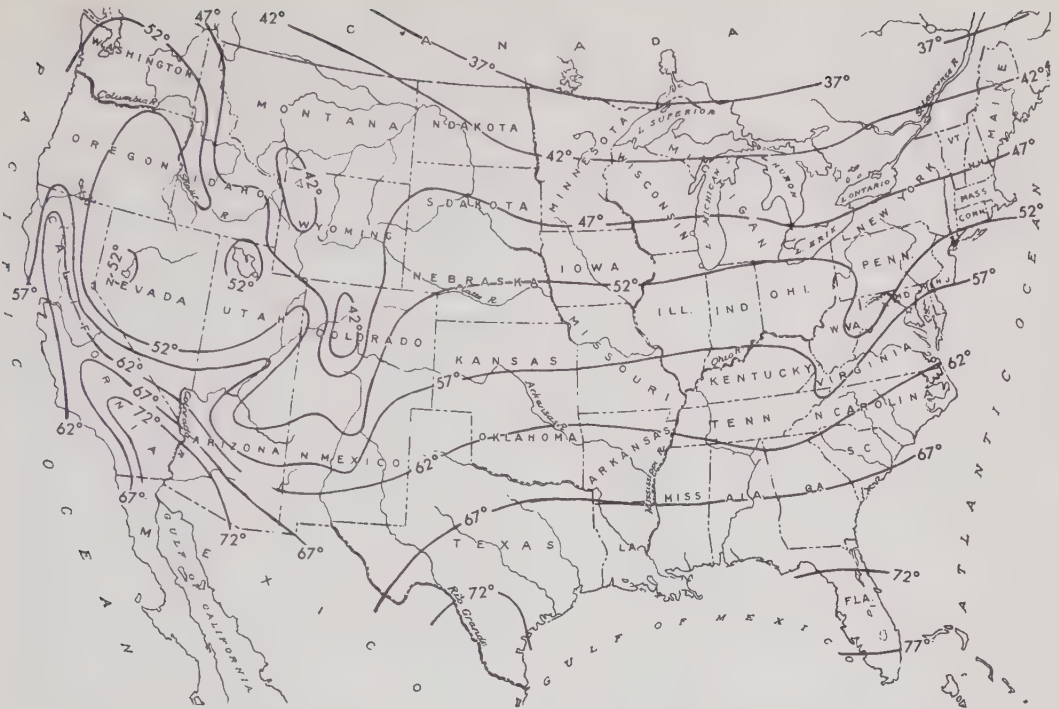
**HEAT OF FORMATION.** See **CHEMICAL ENERGY; THERMOCHEMISTRY.**

**HEAT OF THE BODY.** See **ANIMAL HEAT; BODY TEMPERATURE.**

**HEAT PUMP**, in engineering, a year round air conditioning system based on the reverse cycle refrigeration principle, supplying heat in cold weather and cool air in warm weather. The source of heat may be the outdoor air, city water, lake, pond or well water or the earth; hence, burning of fuel locally is not required. Power, however, must be used.

When well water is the source of heat, water is pumped through a tank containing a coil through which a cold gas refrigerant flows. The refrigerant, after absorbing heat units contained in the well





Well water temperatures showing available heat exchange rates for heat pump operation

water, passes into an electrically operated compressor which compresses the refrigerant gas to a liquid, intensifying its heat. The hot refrigerant then flows through a second system of coils which are immersed in another tank of water. The water absorbing heat from the refrigerant is sent into a radiator through which air is blown. Warm air is thus circulated. Waste water is returned to the ground. Ground water has four times as many thermal units per pound as air, and air occupies 830 times as much space.

As a cooling system the heat pump reverses the flow of house air. Instead of passing the air over the condenser to warm it, the air is passed over the evaporator where heat is extracted from the air. The heat pump is practical where electric power rates are low enough to compete with costs of fuels and the average winter temperatures are not too low. The term "reversed cycle refrigeration" is not quite accurate. The air flow is merely changed. J. H.

**HEAT STROKE** comes as a result of exposure to excessive heat. Two forms of heat stroke, differing in symptoms and treatment, are recognized.

**Sunstroke, or Thermic Fever.** As a rule this comes on suddenly. Often warning signs are headache, dizziness, nausea and vomiting, or disturbances in vision. Loss of consciousness is the rule. The skin is hot and dry and the face has a peculiar reddish flush. The temperature rises rapidly and may reach 109° F. or more in severe cases. The pulse rate and breathing are both disturbed and in rare cases death can come suddenly. Victims who survive as long as the second day are likely to recover but may always be highly susceptible to heat. Their memory is occasionally permanently damaged. It is probable that the heat center in the brain, which controls heat regulation, is injured. Affected persons should be laid down in a shady, cool place. Clothes should be removed and cold wet cloths applied, especially to the head. Cooling ought not to be carried on too rapidly. Rubbing the limbs gently may help. A physician should be obtained if possible.

**Heat Exhaustion.** The principal symptoms of heat exhaustion are dizziness, excessive sweating, a feeling

of weakness, decrease in the amount of urine, pallor of the face, rapid pulse, and rapid respiration. Unconsciousness is unusual. Frequently there are cramps in the muscles of the limbs or abdomen, which are sometimes called *heat cramps*. The body temperature is likely to be subnormal or only slightly above normal. Headache, loss of appetite, constipation, and muscular weakness may precede the onset of typical heat exhaustion. Rest in a cool place with good air circulation for a prolonged period may be sufficient treatment. The muscular cramps are generally relieved by taking additional salt either through salt tablets or salt water. The application of a hot water bottle to the abdomen may relieve cramps. Massage of the muscles usually helps to ease the cramps.

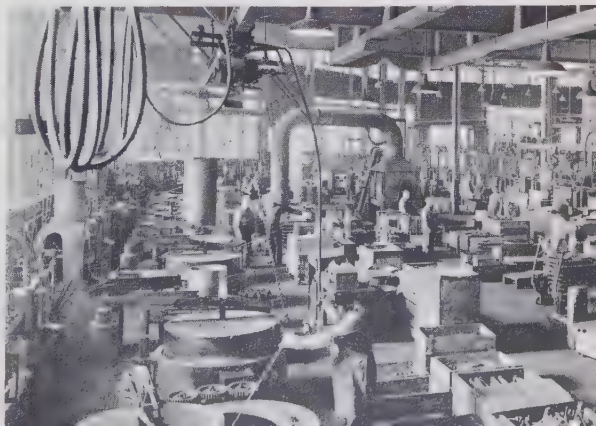
EDWIN P. JORDAN, M.D.

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**HEAT TREATING**, in metallurgy, a combination of heating and cooling operations applied to metals or alloys in the solid state to obtain desired conditions

### Heat treating department in tractor works

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or properties. Heating for the sole purpose of hot-working the material is excluded from this definition.

**Quench and Temper.** A common heat treatment is the hardening of steel by a quench and a draw or temper process. The steel parts are heated at a suitable temperature for quenching by furnace heating or heating in a salt BATH, by flame hardening locally with a torch using a slightly carburizing flame, or by heating by electrical induction. The heated parts are then quenched in oil, water, or some other suitable heat abstracting medium. The parts are then reheated for drawing or tempering at a suitable temperature in a furnace, or in an oil, salt, or lead bath.

**Austempering,** a patented heat treating operation wherein steel parts are heated at a suitable elevated temperature as above, but instead of being quenched in relatively cool oil or water, the parts are quenched in a bath maintained at a predetermined temperature, 500°–900° F. for example, to bring about an isothermal transformation of the AUSTENITE which is the structure of the steel at the high heating temperature. The part is then retained in this heated bath for a definite length of time. It is claimed that steel subjected to this treatment is tougher than the same steel heat treated by the quench and draw treatment.

**Solution Treating and Aging.** This heat treatment is for precipitation-hardening type nonferrous alloys and consists of heating at a suitable high temperature for a definite length of time and quenching rapidly in water. This is known as the solution heat treatment and it is followed by reheating at some lower temperature for a definite length of time to bring about precipitation or age-hardening. This treatment is comparable to the quench and draw treatment of ferrous alloys.

Other heat treatments are ANNEALING, case-hardening, NITRIDING, chill hardening, and metal impregnation heat treatments for anticorrosion protection.

J. E. FOSTER  
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**HEAT WAVE.** This term denotes uncomfortably and abnormally hot weather for any particular locality, lasting more than a day or so with high temperatures, high humidities or a combination of both. The stagnation of a low pressure area may be the cause. This in turn may be caused by a stationary high pressure area to the east. When the heat wave is widespread the southerly winds carry the excessive heat for thousands of miles. See DROUGHT; METEOROLOGY; WEATHER.

**HEATH AND HEATHER,** the common names of two genera of plants belonging to the Heath family, *Ericaceae*. Although the word is sometimes confused in its application, the heather of English literature properly applies to the genus *Calluna*, sometimes popularly called ling, whereas the name heath is applied strictly to species of *Erica*. With nearly 500

species, *Erica* is the largest genus of the heath family. Most of the species are native to South Africa and the Mediterranean region. They are all evergreen shrubs or bushes with tough stems, hard, stiff leaves generally in whorls of three to six, and flowers usually tubular or bell-shaped, white, rosy, or yellow.

South African species have been the progenitors of most of the heaths that have been cultivated to any extent. In former times heaths of Australia and South Africa were extensively grown indoors in Europe. Because of the great care necessary in their cultivation, the growing of heaths is very specialized, and commercial varieties formerly were imported largely from England, Germany, and France. The heaths usually grown are the softwooded types, since hardwooded types need a longer period in which to grow and ripen. Heath thrives best in a good peat soil. One difficulty of heath culture in the United States is the relatively poor quality of the peat soil, but a porous peat combined with coarse sand has been found to be a satisfactory mixture. Another difficulty is the climate of the United States, especially the extremely hot summers, which retard the growth of heath.

After flowering, the plants are trimmed to give them a bushy shape. Between December and April cuttings about one inch in length are selected, especially from tender shoots of young plants. These are set in a container in fine sand and then covered with glass. After rooting, the cuttings are transplanted to small pots in an airy, sunny location. Excessive humidity increases the susceptibility of heaths to a characteristic mildew-like disease.

One of the principal species in cultivation is *E. tetralix*, the cross-leaved heath, native of western Europe. It has leaves in fours and rose-colored flowers larger than those of another common heath, *E. cinerea*. The most popular of all hardy species is *E. carnea*, with leaves in fours and pink, red, or white flowers. The next most popular of the hardy species is *E. mediterranea*, with smaller, rosy flowers. Only one yellow-flowered heath, *E. Cavendishiana*, a hybrid species, is grown in America.

The true name of the plant commonly called heath, and naturalized in the United States from Rhode Island to Newfoundland, is *Calluna vulgaris*. This is actually the Scotch heather, a low evergreen shrub growing from six inches to three feet tall. Its narrow, thick leaves, placed opposite and in four rows, give a four-sided appearance to the branchlets. Its rosy pink, white, or flesh-colored flowers, which bloom in August and September, are bell-shaped and occur in dense erect racemes. This genus differs from *Erica* mainly in having a more deeply four-parted calyx and also in the structure of the anthers. The one species known is found wild in western and northern Europe and in Asia Minor. The culture of *Calluna* is similar to that of *Erica*. It is a satisfactory small shrub for landscaping or for planting about margins of evergreen hedges.

In northern and western Europe *C. vulgaris* forms the chief vegetation on extensive wastelands, known as heaths, where the soil is sterile or acid. In the moorlands, heather is a conspicuous plant. In rural sections where it grows, it is used extensively; the larger stems are made into brooms, the shorter ones are tied into bundles for brushes, and the long trailing branches are woven into baskets. Peat encrusted roots of heather are often used as fuel.

J. A. STEYERMARK

**HEATING AND VENTILATING ENGINEERS, AMERICAN SOCIETY OF,** is an organization dedicated to improving heating, ventilating, and air conditioning through the interchange of ideas and the stimulation of scientific research and invention. Founded in 1894 by 75 charter members, the organization had by 1950 reached a membership of 7,700 in local chapters throughout the United States. Society members represent the fields of consulting

Heat treating a gear before quenching

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engineering; contracting; engineering education; research; public health; and the development, manufacture, and installation of equipment for heating, ventilating, and air conditioning. Society headquarters are at 51 Madison Avenue, New York City.

## HEATING AND VENTILATION

*Your comfort and health depend upon the temperature, the relative humidity, the motion of the air which surrounds you*

**HEATING AND VENTILATION.** Air, the material dealt with in ventilation, comprises the gaseous envelope surrounding the earth and enveloping everything on its surface. It is a mechanical mixture principally of nitrogen, oxygen, water vapor and carbon dioxide, in which varying amounts of impurities, such as smoke and dust, are carried in suspension. Its density is greatest at the surface of the earth where the depth of the gas is greatest, weighing there about one-thirteenth of a pound per cubic foot. The gas mixture becomes more rarefied and, therefore, lighter the farther up it is from the surface of the earth. At about 50 miles up it is assumed to be so rarefied as to be, for practical purposes, nonexistent. See **ATMOSPHERE**.

Man early discovered that the atmosphere in which he lived was an important factor in his comfort and health; when it was too cold he suffered; when it was too hot he suffered; when the air was heavy with dirt and pollution he became ill. The atmosphere made intimate contact with the outer surface of his body and he took it into his system through his respiratory tract and lungs. The need of some control of the atmosphere for health and comfort was early apparent.

**Control of Environmental Conditions** has been as rapid in engineering progress as in any other field. From the open fire for heating and a flap in the entrance door for ventilation, the science of heating, ventilating and air conditioning has progressed until it is now possible automatically to control all of the factors required in the establishment of a proper atmosphere. The early attempts at providing comfort were confined to heating in cold weather. Temperature is the first sensation noticed in a room, so it is natural that heating would be the first condition to receive attention. The removal of heat from enclosed spaces to keep temperatures from rising above the limits for health and comfort, control of humidity and air purification, came later. Thus the science of ventilation was born.

**Ventilation** is briefly defined as the process of supplying or removing air by natural or mechanical means to or from any space. This implies air motion, so problems of ventilation cannot even by simple definition be separated from problems of air motion and distribution. The simple definition implies quantity but does not specifically include quality of air or its condition. In practical, modern applications, however, whether the ventilation of spaces be designed for health and comfort for human occupancy or to meet the needs of industry, both the quantity of air moved and its quality and condition must be given consideration. Since this includes factors of temperature, relative humidity, air motion and purity, the studies of heating and cooling, air conditioning and purification, all become involved in studies of ventilation as understood today. The applications extend into the control of the air environment for industry and for human health and comfort, but this introduction is confined to the field of ventilation as applied to health and comfort of humans.

**Physical Reactions.** The action of air on moist surfaces such as skin with which it comes in contact, depends upon its motion over the surface, its temperature and its relative humidity. Air motion always has

a cooling effect because it increases heat loss by conduction and convection and by evaporation; the temperature of the atmosphere surrounding the body affects the rate of heat loss from the body; the relative humidity determines the rate at which moisture will be evaporated from the surface, the lower the relative humidity the thirstier is the air and the more rapidly it will take up moisture with corresponding increased cooling effects. For physical reactions on the surface of the body, therefore, control must be had over the air motion, its temperature and its relative humidity. The results from drawing air into the lungs containing fine dust particles, most of which remain in the lungs or respiratory tract, or air containing toxic gases, as indicated by the reports of illness and death from air-borne diseases and from lungs congested with foreign particles, shows the need of the maintenance of air purity. Most states have taken cognizance of the danger of air pollution in factories and mills by passing laws on industrial hygiene that include the compulsory maintenance of a safe atmosphere by the removal of deleterious gases and dust resulting from industrial processes.

Ventilation now contemplates a continuous supply of air in such quantities, at such temperatures, relative humidity and purity as will meet all requirements for the maintenance of health and safety standards in enclosed places that will be occupied by humans. Too often outdoor air is referred to as "fresh air." The mere introduction of outdoor air as it is found, especially in urban communities, does not insure a supply of air of the quality contemplated in modern ventilation. Outdoor air may and often does carry with it odors, dust and even toxic gases or other foreign substances that must be removed before the air is suitable for breathing. Today, outdoor air is cleaned and purified by passing it through filters, washers or electrostatic precipitators before it is used for ventilation. Modern health and comfort requirements cannot be met by merely opening or closing a window, or opening or closing a radiator valve.

Air has both chemical and physical properties, but generally it is the physical characteristics that determine the degree or quality of ventilation provided. When there are no processes carried on in an enclosed space that liberate objectionable gases or fine dust, the minimum quantity of purified outdoor air introduced into a space for ventilation is usually determined by the quantity required to dilute odors below the threshold of perception and to maintain relative humidity within reasonable limits. The total quantity must be dependent on the number of occupants and the nature of the occupancy. In ordinary assembly it has been found that not less than 10 cubic feet of outdoor air must be introduced per person per minute to control odor and relative humidity. Since ventilation is largely a dilution process insofar as control of odors is concerned, the volume of any air required must vary with the rate of contamination. When activities are carried on that result in the liberation of toxic gases or that add impurities, such as finely divided dust or foreign particles, the best control provides for a check at the source by local air exhaust systems that establish local areas of air motion high enough to prevent the contamination from becoming general throughout the space. Since rapid air movement is not conducive to comfort, a combination of air supply and mechanical air exhaust in the same room must be designed carefully to avoid disagreeable drafts.

**Modern Heating, Ventilating and Air Conditioning** in spaces intended for human occupancy provide for the maintenance and control of an atmosphere that will promote comfort and health, so the following factors must be controlled: (1) temperature; (2) relative humidity; (3) motion; (4) freedom from impurities; (5) freedom from odors. The relationship between the first three factors determines the feeling of warmth; for the same feeling

of warmth the temperature of the room must be raised as the relative humidity decreases or as the air motion increases. The importance of air environmental control is indicated by the numbers of large industries that are devoted to the manufacture and installation of equipment for the control of room temperatures, relative humidity and motion of air and to clean and purify air by the removal of dust and other foreign substances.

**Body Heat Loss.** The body loses heat to the space around it, principally by the evaporation of moisture (perspiration) from the skin, by convection and by radiation. The relative rate of heat loss by each will depend upon the room temperature, air motion and relative humidity. The heat lost by convection depends upon the temperature of the air and the air motion; the heat lost by evaporation depends upon the relative humidity and the air motion; the heat lost by radiation depends upon the difference in temperatures between the temperature of the skin and that of the surrounding walls and furnishings. Of the total heat loss from the body then, the proportion lost by radiation and convection increases as room temperature decreases, while the proportion lost by evaporation increases as room temperature increases. Under conditions usually found in winter in a home living room at a temperature of 70° Fahrenheit and 30 per cent relative humidity, an adult at rest will lose approximately 100 Btu per hour by evaporation of moisture from the skin and 300 Btu per hour by radiation and convection. As activities change, environmental conditions affecting the feeling of warmth and comfort must be changed.

**Fundamental Physiological Reactions** of the human system to its air environment require a short review to make the importance of the provision of a suitable environment understood. The human body is considered as an energy conversion plant operating in such a way that all actions and functions result in the production of heat. The amount of heat so produced varies from 400 Btu per hour for a person at rest to over 1,000 Btu per hour for a person in active exercise. Since the normal body maintains a constant temperature of 98.6° F., and since the production of heat by the body is taking place all of the time as long as life lasts, it is evident that the rate of heat dissipation from the body must be at the same rate as its production; otherwise the body temperature would rise or fall. This control is maintained automatically by the regulatory system of the body, among other ways, partly by regulating the flow of blood near the surface and partly by controlling the excitation of the sweat glands. When it is easy for the body to adjust the rate of heat dissipation to equal the rate of heat generation, comfort exists; when there is difficulty keeping the heat dissipation as rapid as the heat generation we feel too warm; when the heat dissipation is too rapid we feel cold. The room environment should be maintained so body heat is not dissipated too slowly or too rapidly for comfort.

**Air Supply** may be either natural or mechanical. Supply by natural means is such as can be had without the use of motors, engines or other mechanical sources of power. Air entering or leaving a room by open windows, doors, skylights or through shafts or flues not equipped with any mechanical aid is termed natural ventilation. Since the force that moves air in natural ventilation arises from the difference in air pressures between one part of the system and another, established by differences in temperatures or wind pressures, the quantities of air flowing in such a system vary materially from time to time so they cannot be exactly predicted; therefore, neither can the results be predicted. Mechanical ventilation is the term given to that in which air flow is produced as a result of the application of power-driven blowers or fans supplying air to or taking air from enclosed spaces. The quantity of air supplied to or taken from a space in this way is controllable and, therefore,

predictable; if exact results from ventilation are essential, if exact conditions must be maintained in a room, mechanical ventilation must have preference over natural ventilation. Only in this way can the temperature, relative humidity, purity of air, and volumes, be assured.

Different arrangements of heating, ventilating and air conditioning equipment are available to fit almost any need, both in systems operating on the central station principle where several rooms are conditioned and controlled from one central point, and in the unit principle where the heating, cooling, air motion and cleaning units are located directly in the space to be served.

**Control.** In order to maintain a comfortable temperature in any enclosed space, heat must be supplied to it at the same rate as it is lost. Every building or room loses heat to the outside whenever the outside temperature is lower than the inside, at a rate proportionate to the difference in temperatures between the outside and the inside. The rate, too, will depend upon the type of construction. A construction that offers high resistance to heat flow will lose heat more slowly than one that offers less resistance, so will make possible the maintenance of comfort conditions with less heat supply and, therefore, at lower fuel costs. This explains the importance of tight construction to check air leakage or excessive infiltration, and the value of insulation on outside walls and roofs. The same principles apply in the establishment of barriers against heat flow from the outside to the inside in cooling.

Whether heat is supplied to a room by a heating system or removed from it by a cooling system, the system for both is in reality provided to establish an environment that will permit easy heat dissipation from the body. A heating system decreases the rate of heat loss from the body below what would otherwise exist, while a cooling system increases it. Heating in winter and cooling in summer are both provided for the same purpose—to reduce the strain on the human regulatory system in maintaining a balance between the rate of heat generation and heat dissipation.

When determining the temperature level to maintain, the activity of the occupants and the amount of clothing likely to be worn must be considered. Clothing is insulation on the body that affects the ease with which the body generated heat can be dissipated. The thicker and the greater the number of layers of clothing, the more insulation against heat loss is established and the lower must be the room temperature for comfort. The more physically active the occupants are, the higher will be the rate of heat production by the body and the greater must be the cooling effects by the environment. Winter temperatures in gymnasiums are a case in point.

**Intermittently Heated Buildings**, such as schools and churches, must be supplied with heat during the warming up period greater than that required to maintain the heat balance once rooms have reached the desired temperature because of the heat absorption by the building structure in bringing it up to temperature. Materials require heat and in raising the temperature in proportion to the product of their mass and specific heat. Since the mass in many building structures is great, the load on the heating system in bringing the structure up to temperature will exceed that required once the desired temperature level has been attained. Since the body loses heat by radiation to cold walls and furnishings, the excessive loss of heat from the body in intermittently heated buildings often brings a feeling of chill and discomfort during early sessions even when the air in the room is at a normal temperature of 70° F. The same factors that cause an excess in the heating load in raising the temperature of the materials in the structure operate to increase the load on a cooling system when room temperatures must be lowered.



**Variety in Heating Systems** is great. In general they may be classified as systems that heat by convection and systems that heat by radiation. The warm air furnace in which air is warmed by passing it over the heated surface of a furnace and then carried by ducts to the rooms to be heated, either by the force of gravity or as a result of fan pressure, is the most common example of a convection heating system. Since the success of this system depends on air distribution and motion that will establish a reasonably uniform temperature within the rooms, the location of the air inlets and outlets is important. The system has the advantage of generally lower first cost even with air cleaning and forced circulation equipment added, and provides a quick response to a call for heat. It is easily adapted to a combination system that will provide cooling in summer and heating in winter by providing the necessary equipment and controls. The plenum system of combined ventilation and heating where air is blown over steam radiators then through ducts to the spaces to be ventilated and heated, is another example of convection or what is sometimes termed indirect heating. These systems equipped with either hand or automatically operated dampers that control the relative amounts of outdoor air and recirculated air, that make adequate provision for air cleaning, temperature and humidity control, can be designed to fulfill all requirements for a comfortable, healthful air environment. In shops and workrooms much heating is done by convector units, termed unit heaters, that consist of heating elements and a blower or fan housed in one unit. Air is blown over the heating surfaces and into the room in volumes and at temperatures to maintain the room at the desired level. Similar units that have a connection for outside air are termed unit ventilators. Proper ventilation increases the heating load because with ventilation provided, part of the air circulated must be outdoor air and the same volume as the new air taken in must be wasted to outdoors, carrying with it heat units required in warming it to room temperatures. The heat loss from air used in ventilation and wasted from the building must be added to the heat loss by radiation from the building structure in determining the total heat requirements. See FURNACE.

**The Radiant or Direct Heater**, first to appear, was the common room stove. This was superseded by radiators exposed in the room, kept hot by steam or hot water supplied to them through piping from a central boiler or furnace room. The modifications of piping arrangements, mechanical devices and appliances used in both hot water and steam radiator systems are many, each with their purpose and proponents. For years it was the general practice to install radiators exposed in the room, usually beneath windows where the chilling effects were greatest. The unsightly appearance of these units in finished rooms brought about their concealment by recessing them flush with the inside wall with provision for air entering at the floor line passing up over their heated surface and out into the room through an opening above the line of the radiator top. These units are termed "convectors" because their heating effects come more from the convection air currents than from radiation. Radiant heating obtained by burying low temperature heating pipes or ducts in floors, walls or ceilings, finds much support as a heating system that will provide comfort at low room temperatures. Since the heating effect from any surface is proportionate to the difference in temperature between the temperature of the heating surface and the temperature of the space in which it is placed, the amount of such heating surface must be increased as its temperature is decreased. For example, a free standing direct radiator filled with steam at one pound pressure will deliver heat units to the room at the rate of 240 Btu per hour for every square foot of heating surface. The same radiator filled with water at 160° will deliver only 150 Btu per hour.

**Cooling Space in Summer** is needed to ease strain on the human heat regulatory system just as is the heating of spaces for comfort in winter. Advantage is often taken of natural cooling in those localities where nights are cool and days are hot. Operating attic exhaust fans at night will exhaust all of the heated air out of the building and replace it with cool night air. Openings to the outside are closed during the hot part of the day. Artificial cooling is usually accomplished by blowing air over refrigerated surfaces, reducing the air's temperature so that when it is discharged into the space to be conditioned the temperature of all the air in that room will be reduced to comfort limits. Since an increase in the cooling effect of air can be obtained by a reduction in its relative humidity, cooling is usually accomplished through a combination of reduction in air temperature and reduction in its moisture content. Since there is a practical limit below which air cannot be cooled for introduction into a room, the number of heat units to be extracted from a room will establish the minimum volume of air to be handled by the cooling system. While 70° F. has been generally accepted as a comfortable room temperature during the heating season for those engaged in light work, a temperature several degrees higher must be carried to provide equal comfort in summer. In fact, rooms are seldom cooled more than 15° below the outside temperature. The insulation of buildings and improvements in construction to make them more comfortable and easier to heat in winter, also makes them more comfortable and cooler in summer for it establishes a barrier against the easy heat flow either way.

The relative humidity of air is a comfort factor in both heating and cooling since it affects the rate of evaporation from the skin and, therefore, the cooling effect. There exists a definite relationship between the capacity of air to hold moisture and its temperature. The amount of water vapor in air required to bring about a condition of saturation increases rapidly as the temperature of the air increases. Air at 32° F. is saturated when it contains 26.40 grains of moisture per pound, while air at 70° F. requires 110.2 grains for saturation. Therefore, when air at a temperature of 32° F. and 50 per cent relative humidity is warmed to 70° F. without adding any moisture, its relative humidity will be but 12 per cent of saturation, and it will be in a condition to pick up moisture from the skin very rapidly. This cooling effect by evaporation explains why a space in which air is dry must be heated to a temperature higher than one in which the air is normally moist to obtain the same degree of comfort. The same feeling of warmth is experienced in an atmosphere at a temperature of 66° F. with 50 per cent relative humidity as in an atmosphere at a temperature of 70° F. and 20 per cent relative humidity.

Since cooling effects are desirable in the cooling season (summer) and are undesirable in the heating season (winter), the control of relative humidity in both winter and summer is important for comfort control. In general, moisture must be added to the atmosphere in winter when heating is provided and taken out of it in summer when cooling is provided. It can be added by vapor jets or evaporative devices exposed to the air and can be extracted by passing the air over refrigerated surfaces or through chilled water sprays until the air is cooled below the dew point where some of its moisture is condensed out, or by passing the air over hygroscopic adsorber materials. The maintenance of the relative humidity between the practical limits of 30 per cent and 70 per cent of saturation is suitable for both health and comfort. See AIR CONDITIONING; HUMIDIFICATION; HUMIDITY.

JOHN HOWATT

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**HEATING, HIGH FREQUENCY**, a means of heating by the use of high frequency magnetic or electrostatic forces. Two separate methods of high frequency heating are known: induction heating and dielectric heating. Each of these has unique advantages over conventional heating methods.

#### INDUCTION HEATING

Induction heating is a method of raising the temperature of an electrically conductive work-piece, generally metallic, by the transfer of electromagnetic energy from a high frequency coil. It was known to the pioneer scientists in electrical research that a fluctuating magnetic field, such as is set up by a coil-shaped wire carrying an alternating current, results in a flow of electric current in any electrically conductive object within the field of the coil, although no electrical connection is made between the coil and the material which is heated. The English physicist, Oliver Heaviside, in 1884 published studies of eddy currents due to alternating magnetic fields. In 1890, a U.S. patent was granted to Edward A. Colby for an induction heated furnace.

In its simplest form, an induction furnace is a crucible surrounded by a coil of wire. When an alternating current is sent through the wire, a mass of metal placed in the crucible will be melted by the currents induced in the metal. These induced currents travel in closed loops, known as eddy currents, or Foucault currents, and their action against the resistance of the metal to the passage of current results in

an immediate rise in temperature. Eddy currents tend to flow so as to build up an induced magnetic field of their own which is in opposition at all times to the field producing excitation, in accordance with Lenz's Law. The heat developed by eddy currents may be determined by the following relationship:

$$H = C f^n I^2$$

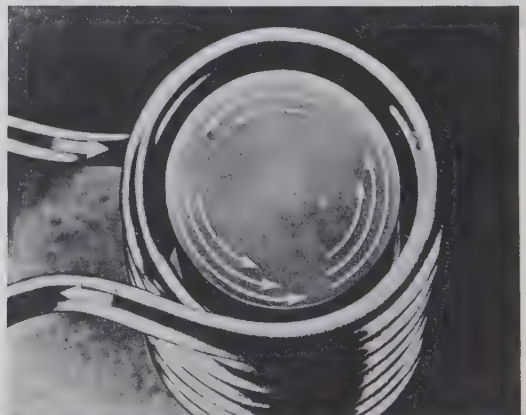
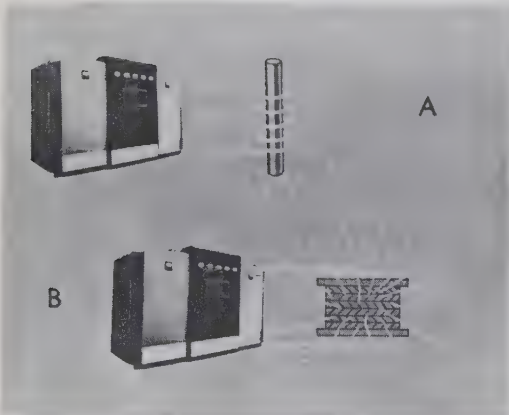
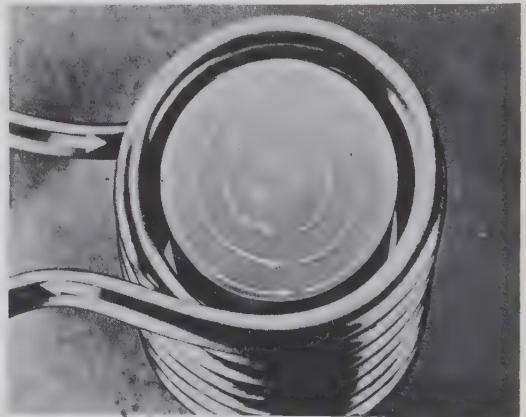
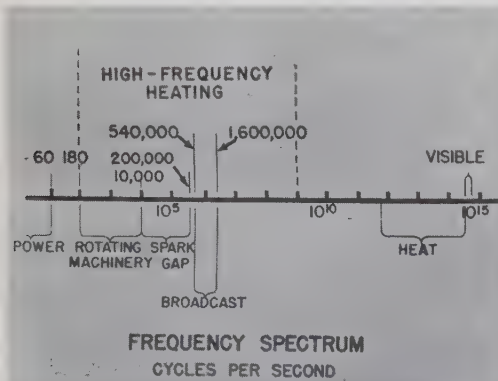
in which C is a constant for the particular material, I is the applied current, and f is the frequency. The additional heat due to magnetic hysteresis, becomes insignificant at high temperatures.

#### HEAT TREATMENT

Machine parts requiring localized heat treatment are ideally suited to induction heating techniques. The areas requiring heat treatment are placed adjacent to a few turns of heavy copper tubing and a high frequency current is then applied. Induced currents will rapidly raise the surface temperature of the work to the required level, without warping or otherwise affecting the part.

A rise in frequency in the applied currents results in greater heating at the surface of the work, but the depth of heating decreases. For deep penetration, frequencies of 5,000 to 10,000 cycles per second are used. For very thin surface heating, frequencies of 500,000 to one million cycles per second are required.

**Alloy-melting**, commercially, in the electric furnace is possible with almost unlimited speed, using a continuous process. The molten charge is mixed and circulated by the magnetic forces, with improved metallurgical results. A charge of Chromel alloy, in a 600-lb. capacity furnace, will melt in 30 seconds. Crucibles of bonded silica, magnesia, graphite, and clay-graphite are commonly used.



Frequencies for a.c. Heating (upper left). Circuits for induction (A) and dielectric (B) heating (lower left). Induced currents in work piece (upper right). "Skin effect" from high frequencies (lower right)



## DIELECTRIC HEATING

Dielectric heating is a method of heating materials which are nonconductors of electricity. The material to be heated is placed between two electrodes, usually parallel plates spaced evenly apart, and very high frequency alternating voltage is applied. Voltages of from 2,000 to 20,000 volts are commonly used at frequencies of 5 to 100 million cycles. Vacuum tube oscillators, similar to equipment used for induction heating, generate the voltages and frequencies necessary.

An electric, or electrostatic field exists in the nonconducting medium separating and enclosing all electric charges. Such a region is known as a dielectric. The shape of the electric field between two parallel plane electrodes may be represented by straight parallel lines of electric force, if the dielectric is uniform. These lines of force pass from the positive to the negative electrode, and indicate the direction of electric forces or stresses in the inter-molecular spaces of the dielectric. A rise in voltage across the electrodes will increase the strength of the field. When the applied voltage is reversed, the lines of force must realign themselves in an opposite direction and in so doing will encounter the opposition of the dielectric to such change. An increase in the frequency of alternations or an increase in voltage will generate considerable heat by this action of electric forces directly on the molecules of the dielectric. Materials which offer greater opposition to the passage of electric lines of force will be heated more rapidly. This phenomenon, analogous to magnetic effects in iron, is known as dielectric hysteresis. The quantity of heat produced in a given charge may be approximated by the relationship:

$$H = E^2 f K \frac{\text{Area}}{\text{Thickness}}$$

E represents the applied voltage, f is the frequency, and K is the loss factor of the material used.

**Applications.** Dielectric heating is applicable to innumerable nonconducting materials. Plywood bonding, preheating of powdered plastic materials into forms for molding, vulcanizing of rubber, continuous treatment of paper using rolling electrodes, dehydration of foods, accelerated bonding of synthetic resin adhesives, welding of glass, defrosting of frozen foods, glue-setting, and fever-therapy, are examples of the wide range of processes to which dielectric heating is applicable. In plastic molding, a time saving of 95 per cent may be effected. Glue-setting time is reduced from eight hours to 20 minutes.

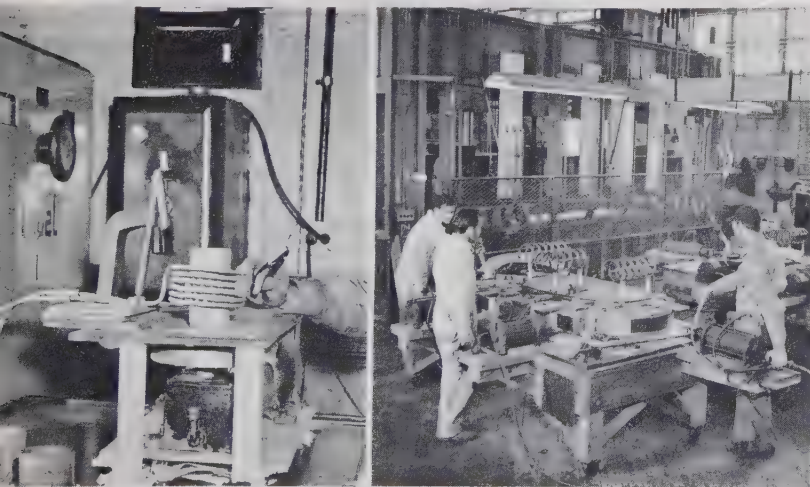
**Power Equipment** depending on high frequency

electronic generators is used for both dielectric and induction heating. Dielectric heating is, however, not efficient at frequencies less than one million cycles per second. Induction heating depends on magnetic forces and eddy currents and is, therefore, proportional to the square of the applied current; dielectric heating makes use of electrostatic forces and is proportional to the square of the applied voltage. Induction heating requires an electrically conductive material, and working temperatures are often from 2,000° F. to 3,000° F. Dielectric heating is used with nonconducting materials at temperatures usually limited to several hundred degrees Fahrenheit or lower. Induction heating is practical at frequency ranges of from 60 to one million cycles. Dielectric heating requires frequencies of one million to 100 million cycles. A choice between these two methods is not likely to occur, each being limited to a distinctive class of materials. See **ELECTRONICS; HEAT TREATING; METALLURGY.** **AARON L. ZOLOT**

**HEAVEN**, a name given to an undetermined locality believed to be the eternal state of perfect happiness, the dwelling place of God, ANGELS, and SAINTS. All tribes, races and religions have held some belief in a type of happiness after death. Whether this was to be attained in a specific location or to consist merely in a state of being, opinions have varied. Heaven, as a place, has been assigned to numerous regions—above, below, and on the earth. In the Greek and Roman religions heaven is the place of the higher gods; but the place of reward for good men is usually placed somewhere upon or beneath the earth. Hesiod speaks of the ISLES OF THE BLESSED as the destined home of the just; Pindar assigns them to the ELYSIAN FIELDS in the remote west; Virgil sends them under the earth. Other writers believed that the locality of the departed was in the air, among the stars or on the sun. The happiness in these regions was usually considered a more or less sensuous kind. The *Koran*, the sacred book of Mohammedanism, adopts the Cabalistic idea of seven heavens which rise above each other like the stories of a building; among the chief happinesses of heaven are the unrestricted and inexhaustible joys of sense. The seventh heaven is the abode of God.

**Biblical Conception.** Even in the Hebrew scriptures heaven is not regarded as the ultimate home of the godly. Its locality is believed to be the atmospheric region, and the firmament in which the sun, moon, and stars move; it is the high and holy place where God dwells; it is always, however, an actual section of the world, which cannot contain God, and which, with all its seeming permanence, will later

give place to something better. The few passages of the Old Testament which speak of, or rather hint at, immortality for the just, express a longing for continued communion with God, rather than for a mere place of reward. In the New Testament the notion of locality recedes more and more into the background, though it does not entirely disappear. Christ, for example, is taken "up" into heaven. But the term signifies an increasingly spiritualized conception. Heaven becomes the supramundane state of realized aspirations, transfigured lives, and the abundant recompense of seeing God, who is the sum and center of felicity. This sight, in Christianity, is believed to entail a spiritual possession of God, referred to by St. Paul's "face



PITTSBURGH COMM. HEAT TREATING CO.-ADOLPHUS RICE MILLING CO.

**High Frequency Induction Heating Unit** for localized hardening operations, left; large laminated sections set up for dielectric heating, right

to face." The happiness of heaven differs in degree according to the merits of each creature; seeing God, therefore, varies in intensity through different spectators.

R. T.

**HEAVISIDE, OLIVER**, 1850–1925, English physicist, was born in London. Through the influence of his uncle, **SIR CHARLES WHEATSTONE**, he decided to enter the field of telegraphy and for several years was connected with the Great Northern Telegraph Company at Newcastle-on-Tyne. After 1874 increasing deafness compelled him to turn to mathematical research and the study of electromagnetism and wireless-wave propagation. His fame rested on his theory of the distortionless circuit, which pointed the way to the development of long-distance telephony by **MICHAEL PUPIN**. He also suggested the existence of the ionized upper region, from 60 to 200 miles above the earth, now known as the Kennelly-Heaviside Layer; as this layer serves as a reflector, it enables radio waves to be reflected so as to travel around the earth and has thus made possible short-wave broadcasting. Among his publications were *Electrical Papers* (2 vols. 1892) and *Electromagnetic Theory* (3 vols., 1893, 1899, 1912). See **KENNELLY, ARTHUR EDWIN**.

**HEAVY WATER**, the name commonly applied to water made up of molecules consisting of two atoms of hydrogen of atomic weight 2 (**DEUTERIUM**) combined with one atom of oxygen. Heavy water is also known as deuterium oxide,  $D_2O$ . It may be produced by electrolyzing water until most of the water has been decomposed, and then distilling the remaining liquid. Water has also been formed with hydrogen of atomic weight 3 (**TRITIUM**), and with heavy oxygen isotopes. The properties of heavy water are somewhat different from those of ordinary water, as can be seen in the following table:

| PHYSICAL PROPERTY       | $H_2O$   | $D_2O$   |
|-------------------------|----------|----------|
| Freezing point.....     | 0.0°C.   | 3.8°C.   |
| Boiling point.....      | 100.0°C. | 101.4°C. |
| Density.....            | 1.000    | 1.107    |
| Maximum density at..... | 4°C.     | 11°C.    |

Heavy water has been used as a moderator to slow down the high speed neutrons employed in **FISSION** reactions. A method of producing heavy water by a catalytic hydrogen-water exchange reaction was developed in connection with **ATOMIC BOMB** research. In concentrated form heavy water has been found to be harmful to the growth of plants and animals. Seeds kept in heavy water do not sprout. In 1934 **DR. HAROLD C. UREY** of Columbia University was awarded the Nobel prize for his investigations of heavy water.

E. M. W.

**HEBBELL, FRIEDRICH**, 1813–63, German dramatist and poet, was born in Schleswig-Holstein and settled at Vienna in 1846. His bitter and thwarted youth is reflected in the emotional stress of his dramas, prominent among which are *Judith* (1839), *Gyes and His Ring* (1856), and *The Nibelungs* (1862). He is less known for his lyrical poetry, contained in *Gedichte* (2 vols. 1841–48).

**HEBE**, in Greek mythology, the daughter of Zeus and Hera, was the goddess of youth, and waited on the gods as cupbearer before Ganymede. When **HERCULES** was exalted to heaven, she was given him as his wife. The Romans worshiped her under the name of *Juventas*.

**HEBEL, JOHANN PETER**, 1760–1826, German poet, was born in Basel, Switzerland; became professor at the Karlsruhe gymnasium in 1791; and held several ecclesiastical posts. He is best known for *Allemannische Gedichte* (1803), poems in the Alamannic dialect. He also wrote a number of short stories.

**HEBER, REGINALD**, 1783–1826, Anglican clergyman and writer of hymns, was born in Malpas, Cheshire. Early in life he received academic honors from Oxford, and during the last three years of his

life he was bishop of Calcutta, India. Among his hymns are "From Greenland's Icy Mountains," "The Son of God Goes Forth to War," and "Holy, Holy, Holy, Lord God Almighty." **W. E. GARRISON**

#### HEBREW LANGUAGE AND LITERATURE.

Hebrew, the original language of the **OLD TESTAMENT** and of several books of the **APOCRYPHA**, is one of the Semitic Languages, belonging to the middle or Canaanite branch, and differing only dialectically from Phoenician and Moabitish. The name Hebrew is not given to the language in the Old Testament, its place being taken by "the lip of Canaan" (Isa. 19:18) and *Yehudhith* or Jewish (Isa. 36:11; Neh. 13:24), though it was evidently used in the prologue of Ecclesiasticus. In the New Testament it often stands for Aramaic (John 5:2; Acts 21:40), but was used in the proper sense by the Palestinian rabbis.

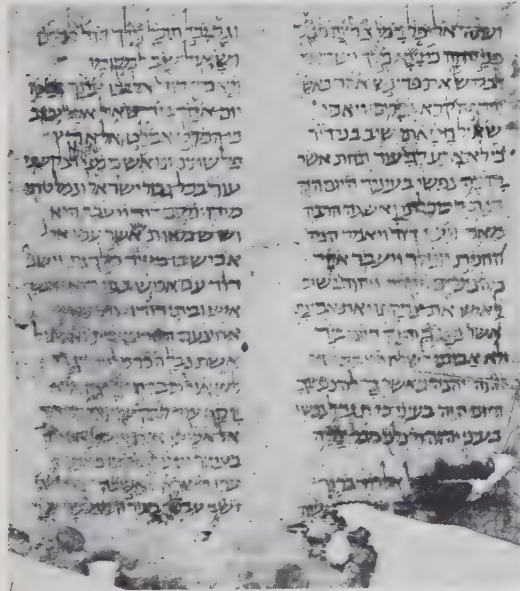
Hebrew, in common with the other Semitic languages, has the following distinctive features: the vast majority of its roots have three consonants; there is a much stronger internal inflection than in Indo-European languages; its verbs have only two tenses—perfect and imperfect; except in proper names it does not form compounds; its syntax is simple and primitive, the prevailing clause-construction being a succession of simple sentences joined together by the particle *we*, "and." A striking peculiarity of Hebrew is the use of *we* as a prefix to the finite verb, which under certain conditions changes the ordinary meanings of the perfect and imperfect into future and past respectively. Hebrew is written from right to left, and originally employed an angular script, still seen in the Moabite stone and the Siloam inscription. This script gradually gave way to the square character now used. At first the vowel sounds were not represented at all, or only partially—by some of the weaker consonants; but in the course of time a system of dots and dashes was devised, which, like the vowel marks of Pitman's shorthand, do not interfere with the consonantal text. This is known as the Massoretic punctuation, and is believed to have been gradually evolved about the sixth or seventh century of our era. It served to fix the meaning of the text, but, while remarkably complete, cannot be considered as a faithful record of the ancient pronunciation. See **MASORAH; SEMITE**.

**Literature.** The ancient literature of Hebrew is contained entirely in the Old Testament. Though this material represents the literary activity of a thousand years or more, there is little linguistic difference between the earliest and latest writers, certainly nothing comparable to the difference between Homer and Plato, or Chaucer and Shakespeare. This remarkable uniformity is best explained by the hypothesis of a continuous process of revision and modernizing. In spite of this leveling tendency there remain certain diversities, particularly in vocabulary, which serve to distinguish two great periods, roughly separated by the return from the Babylonian Captivity. The Hexateuch and the books of the greater prophets were probably written in the first period. To the second belong Chronicles, Ezra, Nehemiah, Ecclesiastes, and Daniel, all of which use a number of Aramaic or Persian words, and therefore belong to the period when the language of the Jews was giving way before that of their Aramaic-speaking neighbors. When the use of Hebrew died out among the common people, the synagogue readings of the ancient Scriptures had to be made intelligible by an Aramaic rendering. This was the origin of the **TARGUM**. Hebrew continued to be cultivated in the learned, rabbinical circles among the Jews, the great products of their scholarship being the **Midrash**, **MISHNA**, and the **TALMUD**. Critical study of the traditional law began in the second century, and the Palestinian and Babylonian versions of the Talmud were completed in the fifth and sixth centuries respectively. The Talmudic scholarship of the Geonim, the heads of the Babylonian schools, found a radical exponent in



BEN JOSEPH SAADIA (892-942), who systematized the traditional philosophy of the Jews and inaugurated the Judaeo-Arabic renaissance. This great revival, which restored the prestige of the Jews in every branch of learning, began in the East, but in the 11th century was transferred to Moorish Spain, which became the center of Jewish culture in Western Europe. Among the great Jewish scholars of this period were IBN GABIROL (1021-58), RASHI (1040-1105), JUDAH HA-LEVI (1085-1140), and IBN EZRA (1092-1167). The *Zohar*, the core of the Kabbalah, is ascribed to Moses of León (d. 1305). Another great medieval scholar was MOSES MAIMONIDES (1135-1204), who produced a remarkable synthesis of Judaic and Aristotelian philosophy.

Until the 18th century, Hebrew was mainly a vehicle for writings on religion and philosophy. Then, partly through the influence of MOSES MENDELSSOHN (1729-86), the language began to be used in creative literature. Notable figures in this modern renaissance were the Chassidic mystic Isaac Leib Peretz (1851-1915), Solomon Jacob Abramowich (1836-1917), Asher Ginsberg (1856-1927), and the great national poet of the Jews, Chayim Bialik (1876-1934). Hebrew is now the everyday speech of the Jewish nation in Palestine, a remarkable linguistic revival due in large part to the efforts of Elieser



Genizah Parchment Fragment in Square Hebrew of a biblical codex from Cairo dates to about the 9th or 10th century. The text is from I Samuel

Ben-Yehudi (1858-1922), who modernized the language, introducing thousands of new words. Although preoccupied with philosophy and sociology, modern Palestine has also produced such creative writers as Abigdor Ha-Meiri, Judah Carni, and Isaac Lamdan. See JEWS, HISTORY OF; BIBLE; ZIONISM. J. J. M.

**HEBREW UNIVERSITY**, in Jerusalem, Palestine, was founded in 1925 as a result of the work of the Zionist Organization and its leader, Dr. Chaim Weizmann. The purpose of the institution, as Weizmann expressed it, was to "play a part as interpreter between the Eastern and Western World." Beginning, as a group of research institutes in various fields, the university has grown to comprise a Faculty of Humanities, which includes an Institute of Jewish Studies and a School of Oriental Studies, and a Faculty of Science, which offers work in the physical and biological sciences and mathematics. There are special laboratories and a staff for cancer research

and in 1949 the Hadassah Medical School was opened. In 1950 Hebrew University merged with the Weizmann Institute of Science after having been forced to move from its buildings on Mt. Scopus because they fell within the new boundaries of Jordan.

**HEBREWS.** See JEWS, HISTORY OF.

**HEBREWS, EPISTLE TO THE**, a book of the New Testament. The epistle falls naturally into four divisions: (1) a comparison of Christ with the angels, the prophets, and Moses, and the claim of his superiority over all others (1-4); (2) the teachings of Christ contrasted with the Mosaic and Levitical system (5-10); (3) the importance of faith, with examples of what faith has meant to characters of the Old Testament (11); (4) a consideration of the Christian virtues and the setting forth of Christ as the supreme example of those virtues (12-13). The intention of the writer of the epistle is apparently to prevent the Jewish Christians from turning again to Judaism. To accomplish this he contrasts the religion of Christ with the older faith and shows Christ as the MESSIAH who is superior to all of the prophets and to Moses. The Mosaic institutions are represented as the prelude to the fulfillment of prophecy in Jesus Christ and his teachings.

The question of the authorship of Hebrews is one which has long perplexed scholars. Although the Authorized Version attributes the epistle to Paul, it has been generally recognized by most modern scholars that the writing is not Pauline. Even Calvin and Beza questioned its Pauline authorship, although it was recognized by Jerome. From the content and the style of the epistle it is believed that the author was a Jewish Christian who wrote about A.D. 95 during the persecution under Domitian. Various names have been suggested by different authorities as the possible author of Hebrews, including Luke, Clement of Rome, Silas, Barnabas, Apollos, and Aquila and Priscilla, but no name can be definitely associated with it if the Pauline authorship is rejected.

As to its destination, the fact that the epistle is addressed "to the Hebrews" does not mean that it was a letter intended for the Jews in general. Rather, it is apparent from the content of the epistle that it was written for a particular church congregation. Traditionally, some church in Palestine has been regarded as the destination, probably the one in Jerusalem. The churches at Alexandria, Rome, and Antioch have also been advocated as the probable destination of the letter.

Regardless of who wrote the letter or to what particular church it was intended to be sent, the epistle is a powerful defense of early Christianity, presenting a theology which is worthy of a place beside that of Paul and John in the New Testament. It is written in a clear, forceful, direct style, and the arguments are presented by the author in a manner which reveals a deep conviction and penetrating religious insight. W. G. D.

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**HEBREWS, GOSPEL ACCORDING TO THE**, a noncanonical book of New Testament Apocrypha.

**HEBRIDES**, or **Western Isles**, largest island group lying off the W coast of Scotland, included with the shires of Ross and Cromarty, Inverness, Argyll, and Bute; area about 1,200 sq. mi.; pop. (1948 est.) 49,750. Stretching 200 miles south from the Butt of Lewis to the Mull of Kintyre, 50 miles west into the Atlantic to the Saint Kilda group, the Outer and Inner Hebrides comprise more than 500 islands. Many are uninhabited except by birds or seals; many are so small as to provide space for lighthouses only. In general the surface of the islands is undulating, with moorland and picturesque lakes. The coast lines are deeply indented by sea lochs. A large per cent of the area of most of the islands is in

## Hebrides

pasture for cattle or sheep. The occupations of the inhabitants of the largest islands include herring fishing, farming, livestock raising, the weaving of tweed and other woolen fabrics, slate and limestone quarrying, and distilling; all of these products are exported. Crops raised on the island farms include potatoes, turnips, barley, and oats. The inhabitants speak Gaelic, and most of them also speak English. There are schools on the larger islands. A great many of the islands have prehistoric, Norse, and monastic remains. The beautiful scenery, the caves, antiquities, and fishing attract hundreds of tourists during the summer.

The Outer Hebrides are separated from the Scotch mainland by North Minch; from the northernmost of the Inner Hebrides by Little Minch and the Sea of Hebrides. The five largest islands of this outer group are Lewis-Harris (forming Long Island), North Uist, South Uist, Benbecula, and Barra. The largest town of the outer group is STORNOWAY, situated on the east coast of Lewis. Satellite groups of smaller islands include the FLANNAN ISLANDS, Saint Kilda, the Barra group, the Shiant, and the North Uist group. Benbecula (area 66 sq. mi.; pop. 500), lies between North and South Uist and has farming and sheep raising. See LEWIS; UIST.

The Saint Kilda group of seven (area about 63 sq. mi.; pop. 75), including Boreray, Duna, Soa, and Hirter, lies 50 miles northwest of North Uist, and is an important station for sea fowl. The group has been owned by the MacLeod clan for centuries.

The Barra group of 20 includes the most southerly of the Outer Hebrides: Barra Head (which has a 580-foot lighthouse), Berneray, Mingulay, Sandray, Vatersay, Gigha, Fuda, Fiaray, Pabbay, and Eriskay (where Prince Charles Edward Stuart, the "Young Pretender," landed in 1745). Castlebay is the chief town of this group.

The Shiant, lie east of Harris and are used by fishermen. The North Uist group includes Ronay, Monach, Hermetray, Boreray, Berneray, Pabbay, Shillay, Baleshare, and Grimsay. Loch Maddy is the chief town.

The Harris group includes Scalpa, Taransay, Ensay, and Killegray. The chief town of Harris is Leyerburgh. At Callernish on Lewis is a group of megaliths akin to those of Stonehenge. About 40 miles north of Lewis are the two groups of Rona and Sula Sgeir.

The Inner Hebrides are separated from the mainland by the sounds of Sleat, Mull, Inner Raasay, and Jura. The largest islands of this group are Skye, Mull, Jura, Iona, Islay, Coll, Tiree, Rum (Rhum), Raasay, Scalpay, Lismore, Colonsay, and Oronsay. Smaller adjacent groups are the Scarba group, the Small Isles of Rum, and the small islands near Mull and near Skye. Coll (area 28 sq. mi.; pop. 700) lies seven miles off the northwest coast of Mull and three miles northeast of Tiree. It is agricultural and pastoral. Lying close are the isles of Sia, Gunna, Rudha, and Eilean. The chief town is Arinagour.

Tiree (area 45 sq. mi.; pop. 1,450) lies 20 miles northwest of Iona. Its inhabitants engage in farming, producing barley, oats, potatoes; in herring fishing; and the raising of cattle, sheep, and poultry. Ducks, geese, chickens, and eggs are exported in large quantities to England. The principal town is Scarinish. Skerryvore, a rocky island 12 miles southwest of Tiree, has a lighthouse which guards the end of a dangerous reef.

Rum (area 42 sq. mi.; pop. 100) lies 16 miles west of Skye, from which it is separated by Cuillin Sound. It is almost wholly moorland and deer forest. The chief town is Kinloch Castle. Eigg (area 12 sq. mi.; pop. 130), largest of the Small Isles of Rum, is separated from Rum by Rum Sound. The inhabitants lead a pastoral life, with some weaving of tweed. Others of the Rum group are Muck, Oigh Sgeir, Canna, and Sanday.



EWING GALLOWAY

### Scene on a rough country road in the Hebrides

Raasay (area 36 sq. mi.; pop. 300) lies between Skye and the Scotch mainland and is separated from Skye by the Sound of Raasay and from the mainland by the Inner Sound. The island is rocky and barren, and produces iron ore. The chief town is Raasay. Rona Island is immediately northeast. Scalpay (area 11 sq. mi.; pop. 40) lies in the east coast curve of Skye in the Inner Sound and has pasture for the sheep grazing. Adjoining isles are Crowlin, Longay, and Pabay.

Lismore (area 19 sq. mi.; pop. 600), which lies at the entrance to the sea loch, Linnhe, northeast of Mull, is largely under cultivation. Here are a 13th-century cathedral, a lighthouse at the southwest extremity, and the remains of several ancient castles. Shuna Isle is northeast. Colonsay and Oronsay (area about 17 sq. mi.; pop. 200) lie nine miles northwest of Islay. St. COLUMBA founded a college at the chief town, Scalasaig. Columba landed at Oransay, the smaller island, in 563; the spot is marked by a large cross. Adjoining islets are Dubh Artach, a lighthouse point, and Rudhana.

The Scarba group, sometimes called the Isles of the Sea (combined area 25 sq. mi.) stretching from the northeast end of Jura along the west coast of Argyll into the Firth of Lorne, include Scarba, Luings, Shuna, Easdale, Seil, Lunga, Kerrara, and Torsay. Scarba is separated from Jura by the strait and whirlpools of Corrievekin. Farming and livestock raising are pursued, and there are slate quarries.

The small Islands surrounding Mull are Staffa, Ulva, Iona, the Trishnish Islets, the Torran Rocks, Erraid, Little Colonsay, and Gometra. Staffa (area 71 acres; uninhabited) lies six miles northeast of Iona; here is the famous FINGAL'S CAVE. Tobermory is Mull's chief town.

In addition to the larger groups surrounding Skye, are Soay, Elgol, and Neist on the south and west; the Ascribs in Loch Snizort on the north, and Fladda on the northwest.

**History.** The Hebrides are the *Eubudae* of Ptolemy and Pliny, and the *Sudreys* (Southern Isles) of the Norsemen. The ancient Celtic dwellers were conquered in the ninth century by the Norse, who held the island until 1266. From that year until 1345 various Scottish chieftains ruled the islands. In 1346 the MacDonalds of Islay established themselves as "Lords of the Isles," and continued in control until the reign of James V, in the 16th century, when all the Hebrides were taken by the crown. Today, many of the larger of both the Outer and Inner Hebrides are privately owned. In the 20th century there has been a great deal of emigration, especially to Canada.

K. E. H.

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**HEBRIDES, NEW.** See **NEW HEBRIDES ISLANDS.**

**HEBRON**, ancient city (Gen. 23:2–19, etc.) of Judah, Palestine, 20 miles S of Jerusalem. The modern town of 20,000 inhabitants surrounds the Jewish enclosure over the rock-cut cavern supposed to be the sepulcher of Abraham, Isaac, Jacob, Sarah, Rebekah, and Leah, representing the cave of Machpelah (Gen. 23:19, etc.) which lay east of Mamre or Hebron (Gen. 13:18). See **CITIES OF REFUGE.**

**HECATE**, a Greek divinity, generally represented as a daughter of Persaeus or Perses, was the only one of the **TITANS** to retain her power under Zeus. She was identified with Selene (the moon) in heaven, Artemis on earth, and Persephone in the nether world, and hence is represented with three bodies or three heads. As a goddess of the lower world, she was the patroness of all kinds of sorcery and witchcraft. She was especially worshiped at crossroads; dogs, honey, and black lambs were offered to her.

**HECHT, BEN**, 1893–, American novelist and dramatist, was born in New York and was brought up in Racine, Wis. He was on the staff of the *Chicago Daily News* (1914–23) and played a colorful role in the Chicago literary renaissance, becoming well known for his daily sketches, later collected as *1001 Afternoons in Chicago* (1923), and publishing with Maxwell Bodenheim the *Chicago Literary Times* (1923–24). He collaborated with Charles MacArthur on the play, *The Front Page* (1928), and on a number of screen plays, notably *The Scoundrel* and *Wuthering Heights*. He wrote many screen plays of his own, and published numerous novels and short stories, among which were *A Jew in Love* (1930), *A Book of Miracles* (1939), and *Collected Stories* (1945). In the troubled times of the Arab-Jewish war in Palestine, Hecht gained notoriety as an active supporter of the Jewish terrorist groups fighting in Palestine, and wrote a propagandist play, *A Flag is Born*, which was produced in New York in 1946.

**HECK, BARBARA**, 1734–1804, a founder of the Methodist church in America, was born in Ballin-garry, county Limerick, Ireland, of German parents. She and her husband had been converted by the preaching of Wesley; they came to New York about 1760, and six years later, with Philip Embury, founded the first Methodist congregation in New York City. At the beginning of the Revolutionary War the Hecks moved to Canada, as they were Loyalists, and founded the first Methodist church there.

**HECKER, ISAAC THOMAS**, 1819–88, American Roman Catholic divine, born in New York City. He joined the Brook Farm community, and afterward was a member of a similar community at Fruitlands, Mass. For a time he lived with Thoreau at the Hermitage. Received into the Catholic church in 1845, he was engaged from 1847–51 in mission work in England, being ordained priest by Cardinal Wiseman (1849). In 1857 he visited Rome, and was authorized to found a new missionary order, the "Paulists," in New York, of which he was the first father superior. He founded (1865), and edited till his death, the *Catholic World*, the chief Roman Catholic organ in the United States. His publications include *Aspirations of Nature* (1857); *Catholicity in the United States* (1879).

**HECKEWELDER, JOHN GOTTLIEB ERNESTUS**, 1743–1823, American Moravian missionary, was born in Bedford, England, and went to Pennsylvania with his parents in 1754. He was a missionary among the Ohio Indians (1771–86), helped arrange Indian treaties for the government (1792–93), aided Ohio Indians to reach Canada (1801–10), and retired to Bethlehem, Pa., to write. Based on his first-hand knowledge of the Indians, his works include: *Account of the History, Manners, and Customs of the Indian Nations Who Once Inhabited Pennsylvania and the Neighboring States* (1819); *A Narrative of the Mission of the United Brethren among the Delaware and the Mohegan Indians . . .*

(1820); *Names Which the Lenni Lennape or Delaware Indians Gave to the Rivers, Streams, and Localities* (1822).

**HECTOGRAPH**, trade-mark name of a device used to duplicate written matter. In essence it consists of a pad of gelatin to which the "master copy," typed in special ink, is transferred. Subsequent copies are impressions from the gelatin pad.

**HECTOR**, champion of Troy in the **TROJAN WAR**, was the eldest son of Priam and Hecuba, the husband of **ANDROMACHE**, and the father of **Astyanax**. His chief exploits are his single combat with Ajax, his pursuit of the Greeks to the ships, and his slaying of **Patroclus**. It was in revenge for this last exploit that **ACHILLES** sought him out and slew him, and then fastened his dead body to his chariot and dragged it to the Greek



Hector dragged behind the car of Achilles

camp. The passages of the *Iliad* which describe the last meeting of Hector and Andromache, her lament upon his death, and the mourning of his mother, wife, and Helen at his funeral, are among the noblest and most pathetic pieces of poetry in all literature.

**HECUBA**, the wife of **PRIAM**, king of Troy, and the mother of Hector, Paris, and others. After the capture of Troy she was taken captive by the Greeks, and after the sacrifice of her daughter Polyxena succeeded in killing Polymestor, king of Thrace, who had murdered her son Polydorus. Finally she was changed into a dog, and leaped into the sea. Euripides has a tragedy named after her.

**HEDGE**. See **FENCE**; **BOUNDARY**.

**HEDGEHOG**, a small insectivorous mammal widely distributed in the northern parts of the Old World, and having the back and sides densely covered with short spines. The neck is short, the black snout shaped like that of the pig, the limbs and tail short. The hedgehog, *Erinaceus europaeus*, possesses the power of rolling itself up into a ball when alarmed, so that nothing but the spines are exposed to the enemy. The diet is very varied, comprising both vegetable and animal matter. Nocturnal in its habits, the hedgehog is most frequently seen at dusk. In winter it hibernates within a burrow. Other species of hedgehog occur in Asia and Africa, while the **PORCUPINE** which is widely found in North America is often incorrectly called a "hedgehog."

**HEDGEHOG PLANT**. See **ECHINOCACTUS**.

**HEDGING**, or "price insurance," is a term used in trading to describe the futures sale or purchase of a commodity to offset a previous purchase or sale, usually in the cash market. Hedging is practiced to reduce or eliminate speculative risk due to price changes in commodities.

The purchaser in a cash market hedges by obtaining a futures contract to sell an equal amount of the same commodity in the future. In the event of a decline in prices, he loses on the cash transaction but gains on the futures. The same method is used by a seller in the cash market to protect himself against a rise in prices. Effective hedging requires careful selection of the market and month for futures trading, and if done successfully maintains a balance between cash sales

or purchases and futures purchases or sales to the extent that the borrowing power of the trader is increased, since banks consider that such transactions are made independent of speculative fluctuation. Cash transactions may be hedged by offsetting purchase or sale of a future in another commodity if there is a dependable parallel price relationship.

In order that hedging may be effective, a close parity between prices in the spot and futures markets and fairly constant price differentials for tenderable grades other than the basis grade must be maintained. Futures market prices are usually determined by what the spot market prices at the time of delivery are expected to be, with a differential for carrying charges, etc. The exchange regulations or Federal statute prescribe the price differentials for other than basis grades. The United States Cotton Futures Act requires that price differentials in effect on the spot market be maintained on the futures market. See COMMODITY EXCHANGE.

**HEDIN, SVEN ANDERS**, 1865–1952, Swedish Asiatic explorer, was born in Stockholm and educated there, at Uppsala, and at Berlin. While still a student he made his first journey to Persia and Mesopotamia (1885–86) and in 1890 was a member of King Oscar's embassy to the shah of Persia. He later traveled (1890–91) through the central Asian khanates to Kashgar, traversing Khurasan and Turkestan. But his real work as an explorer began when he crossed the Pamirs in the dead of winter (1893). The following summer he attempted to reach the summit of Mustagh Ata, climbing 20,660 feet. In 1895 he crossed the desert of Takla Makan, nearly losing his life, and discovered the ruins of an ancient city (Borasan) and traces of Buddhistic civilization. He completed his journey at Peking, via Lop Nor and Tibet.

In 1899 Hedin floated down the Tarim and dug from the sands of its northern shore evidences of the Chinese civilization of the third century. The next few years he spent in Tibet, crossing it from north to south and from east to west; disguised as a Mongol, he twice attempted to enter forbidden Lhasa. In 1905 he began a trip through Persia, India, and Tibet, crossing the Himalayas eight times and finishing his journey in British India. He made valuable discoveries, including the sources of the Brahmaputra and Indus rivers, Lake Churnitso, several mountain ranges, and much unmapped territory.

In 1926 Hedin directed the Sino-Swedish Expedition, a great undertaking which occupied him until 1933. In 1933–34 he mapped the Silk Road, the famous Chinese caravan trail in the interior, for the Chinese government, which wanted to construct an automobile road through Sinkiang in order to better control that dependency.

Hedin took a conspicuous part in the controversy over the separation of Norway and Sweden, holding that an actual rupture was unnecessary. However, such political activity on his part was only occasional, as he spent little time in his native country. He was fervently pro-German during both world wars and spent the years 1914–16 with German troops at the European and Asiatic fronts.

Among his writings are: *Through Asia* (2 vols. 1898); *The Scientific Results of a Journey in Central Asia, 1893–1902* (6 vols. 1904–8); *My Life as an Explorer* (1925); *Across the Gobi Desert* (1931); *Jehol, City of Emperors* (1931); *A Conquest of Tibet* (1934); *The Silk Road* (1938); *Wandering Lake* (1940); *Without Assignment in Berlin* (1949).

**HEDMARK**, county, SE Norway, bordered on the E and S by Sweden, on the W by the counties of Akershus and Opland, and on the N by Sor Trondelag; area 10,621 sq. mi.; pop. (1954) 175,648. The highlands of the north, which culminate in the Dovre Fjeld, are very sparsely populated. The chief river is the Glommen, whose valley affords railway connection between Trondheim and Oslo, and whose numerous falls are an important source of water

power. There are many lakes within the county, and Norway's largest lake, Mjosen, lies on the southwestern border. Hedmark is extensively forested, and lumbering is the principal industry. The chief town is Hamar.

**HEDONISM**, the ethical theory which holds that pleasure is the highest good. A distinction has been made between *ethical* and *psychological* hedonism. *Ethical* hedonism, if it is *egoistic*, contends that the individual is justified in doing that which will bring him the greatest pleasure over the longest period of time. *Ethical* hedonism, if it is *universalistic*, is UTILITARIANISM, which maintains that the greatest pleasure of the greatest number is the supreme end of conduct, thereby putting pleasure on a collective, rather than an individual, basis. *Psychological* hedonism affirms that a person's actions are determined by the desire for pleasure, regardless of whether that control represents the highest good or not.

Hedonism constituted the basis of the ancient philosophy of Aristippus and the CYRENAICS (fourth century B.C.) of Greece, who maintained that pleasure of the moment (particularly bodily pleasure) was the highest good. The philosophy of ARISTOTLE is not strictly speaking hedonism, for while he admits that pleasure is necessary for happiness, he differentiates between the two and places happiness on a higher level of importance. Although EPICUREANISM is a type of hedonism, the emphasis is not placed upon immediate pleasures, but rather upon the happiness of a serene and simple life in which restraint and consideration of others play an important part. The social and philanthropic aspects of modern hedonism (utilitarianism), which takes into consideration the greatest pleasure for the greatest number, have imparted to it a moral dignity which was lacking in the earlier types of individualistic hedonism. Numbered among the adherents of this more modern type of hedonism were HERBERT SPENCER and JOHN STUART MILL.

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**HEEL FLY**, a BOTFLY common in the west and south of the United States, which lays its eggs on the hairs about the heels of horses and cattle, whence they are licked off by the animal and transferred to the stomach, where the bots develop.

**HEERLEN**, large coal mining center on the small peninsular SE tip of the Netherlands; in Limburg Province, 15 miles NE of Maastricht and five miles from the German border at Alsdorf. Occupied by Germany during World War II, it was captured by British troops, on Jan. 24, 1945. Pop. (1950) 60,261.

**HEFFELFINGER, WILLIAM WALTER**, known as **Pudge**, 1867–1954, American football player, was born in Minneapolis, Minn. Considered the greatest football lineman of all time, he was an All American guard at Yale in 1889, 1890, and 1891, and a unanimous choice on all time All American teams. He later entered professional football and was an active player until after he was 50.

**HEGEL, GEORG WILHELM FRIEDRICH**, 1770–1831, the greatest German philosopher of the post-Kantian period, was born in Stuttgart. Having studied theology, philosophy, and classics at Tübingen, he taught philosophy at the universities of Jena, Heidelberg, and Berlin. He produced a novel system, which is variously referred to as Hegelianism, Idealism, or Absolute Idealism. Included in his work are not merely the traditional topics of metaphysics, ethics, logic, aesthetics, and theology but also philosophy and history, and a study he virtually founded, the history of philosophy. As a development from, and a consummation of, Kantian thought, Hegel's philosophy enjoyed a wide reputation in England and the United States, as well as on the continent of Europe. His work was sympathetically received by philosophers, many of whom became disciples of



Hegelian Idealism, and by poets, such as Coleridge and Wordsworth, who recognized its importance for bolstering up, and for giving the philosophical foundations of, 19th-century romanticism.

Hegel conceived of philosophy as a "voyage of discovery" and developed *dialectic* as the distinct method of philosophy. Dialectic, as a method, aims at criticism of points of view and at accomplishing, as a result, a synthesis of all knowledge into a unified system. Formally, his dialectic is composed of three parts, or moments. First is the statement of a positive *thesis*, which is alleged to be true. Secondly, any finite, positive statement can be opposed by its opposite, or *anti-thesis*. Finally, since the opposites are both asserted to be true, it becomes necessary to recognize that the statements of the thesis and of the antithesis are only partially true and that their truth must be reformulated on a higher level, which is the *synthesis* of them.



JOHN CRERAR LIB.  
Hegel

The synthesis then becomes a thesis, but on a higher level, and in turn becomes subjected to the dialectical process. The process can come to rest only at the apex of a hierarchical system, when the Absolute Idea is reached and reveals reality in its complete form. Although Hegel's philosophy is not always so completely formalized, the general pattern of the dialectical process is adhered to. Moreover, since thought and reality are not separate in Hegel's philosophy, the dialectical process is the process of reality itself. Thus he insists that "the real is the rational, and the rational is the real."

BERTRAM MORRIS

**Spread of Hegel's Philosophy.** When Hegel took his theological certificate he was rated as especially deficient in philosophy, yet his ideas were to inspire numerous diverse schools of thought in both Europe and America. Practically all modern idealism springs from him or was influenced by his writings. In England the Hegelian philosophy was accepted and adapted by a prominent school, among whom were T. H. GREEN, W. Wallace, BERNARD BOSANQUET, and Francis Bradley. This philosophy provided a middle way to save the values of the old order while taking advantage of the new. It was brought to America by the political refugees of 1848 and by American students educated in German universities. The leading neo-Hegelian in the United States was JOSIAH ROYCE. In Italy this school had been represented by BENEDETTO CROCE and GIOVANNI GENTILE; the contradictory uses to which Hegelianism could be adapted is illustrated by these two men, for the former gained fame as a liberal while the latter, a student of Croce, became the official philosopher and apologist of fascism.

Within Germany diverse schools of thought and political movements called on the name of Hegel, each emphasizing the line in the master's thinking most useful to its own purpose. In general, his ideas were found most congenial by the extreme right and the extreme left. The German liberals who led the uprisings of 1848, while greatly influenced by Hegel, looked upon the cosmopolitan IMMANUEL KANT as their major prophet. Hegel's glorification of the Prussian state made a profound impression on the unphilosophic Prince Bismarck and other leaders of the kind of national unification which culminated in the German Empire of 1871. On the other extreme the social radicals made even better use of Hegelian ideas. KARL MARX took the famous dialectic and turned it upside down. While Hegel had insisted that each concept develops its own opposite, out of which conflict eventually springs a new synthesis, Marx

contended that every economic system contains the seeds of its own destruction and that finally the old gives way to its opposite. Later Marxian thinkers, including Lenin, re-emphasized their devotion to Hegel's dialectic.

A strong counter philosophy to Hegel's idealism was the romantic movement, which gained wide popularity in Germany. A leader in this movement was FRIEDRICH VON SCHELLING, in early life a close friend and collaborator of Hegel. ARTHUR SCHOPENHAUER, the philosopher of pessimism, was bitterly opposed to Hegel. RICHARD WAGNER, the composer, and FRIEDRICH NIETZSCHE, the poetic philosopher of the superman, both represented this romantic movement.

**Political Significance of Hegel.** The development of Hegel's thinking foreshadowed and helped to usher in modern nationalism. Beginning as an internationalist under the influence of Kant, Hegel hailed Napoleon as "the world spirit riding on horseback," and he looked with satisfaction on the defeat of Prussia at Jena (1806). But later this native of Württemberg was called to the University of Berlin, where he became the favorite of the Prussian government. In his philosophy of history he conceived the Prussian state as the supreme manifestation of the universal spirit. He glorified the national state, which he regarded as the embodiment of all ethics and as not subject to any power outside itself. At the same time he was profoundly opposed to the growing democratic movement because of its efforts to make a sharp break with existing conditions, which in Hegel's view, being real, were therefore rational.

The 19th century saw the development of numerous national states, thus following Hegel's historical pattern. Of course it is true that the accompanying trend toward liberal democracy was utterly contrary to his line of thought. Hence there is much in Hegel's idealism which gives support to the 20th century movements of FASCISM and NATIONAL SOCIALISM; indeed these two movements seem to be the logical end product of nationalism.

The most readable of Hegel's books are *Philosophy of Right* (1896) and *Philosophy of History* (1857). His other important works are: *Logic* (ed. 1892-94); *Philosophy of Mind* (1894); *Philosophy of Religion* (1895); and *History of Philosophy* (1892-96). See PHILOSOPHY; ETHICS; IDEALISM.

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HEGIRA. See HEJIRA.

**HEIDEGGER, MARTIN**, 1889—, German philosopher, was born in Messkirch, Baden. An influential existentialist, Heidegger repudiated the existentialism of his pupil Jean-Paul Sartre. Heidegger denied that his philosophy was atheistic, insisting that his "system" was not yet complete and that his viewpoint as a whole was quite different from the atheistic existentialism popular in France after World War II. Emphasizing the basic "absurdity" of human existence, but stressing man's freedom to transcend this absurdity, Heidegger's philosophy was probably closer to that of Karl Jaspers than to that of Sartre. Although existentialism is a philosophy of crucial decisions and action, Heidegger tried to avoid participation in human affairs, and was criticized for not opposing the Nazis more strenuously. His most important work was *Sein und Zeit* (1927).

**HEIDELBERG**, city, Germany, in the state of Baden, beautifully situated between the left bank of the Neckar River and the Königstuhl (1,865 ft.) and other hills, 11 miles by rail SE of Mannheim. The glories of Heidelberg are its university and its castle. The university, founded in 1386 as the first German university, declined in the 17th and 18th centuries, but was given new impetus by Karl



EWING GALLOWAY

**Heidelberg Bridge Gate**, flanked by statues of Bavarian celebrities, is among city's numerous relics

Frederick in 1803. Many famous men have taught at the university, among them Reuchlin, Pufendorf, Gervinius, Kuno Fischer, Helmholtz, and Bunsen. Since 1909 the Heidelberg Academy of Science has been associated with the university. The castle, 330 feet above the Neckar, forms a rude square, with circular towers at the corners, the whole thickly overgrown with ivy. The building, first begun in the 13th century, was devastated by the French in 1622 and 1673, and by lightning in 1764. Additions to the structure were erected in 1556-59, 1601-7, and 1618. During the Nazi period, Goering built a large concert hall in the castle banquet hall. Also in the castle is a gigantic 46,732-gallon wine cask. In the town below, which consists chiefly of one main street two miles long, are the late Gothic Church of the Holy Ghost, contemporary with the oldest part of the castle; the late Gothic St. Peter's Church (15th century); the baroque Jesuit church (18th century); the baroque town hall (18th century); the Renaissance-styled House of the Knights (16th century); and the monument to General von Wrede (1767-1838), a native of the city.

Heidelberg's manufactures include surgical instruments, machinery, railroad cars, fire hose, cigars, leather, cement, and beer. There is trade in books, hops, wine, and tobacco.

Heidelberg was named in 1196 and became a town in 1239. The Heidelberg Catechism (Latin *Catechesis palatina*), a brief religious document outlining the creed of the German Reformed church, was published here in 1563 by the order of Frederick III, elector of the Palatinate. The city and the castle were severely damaged by Tilly's troops in the Thirty Years' War and again by French troops in 1688 and 1693. In 1803 the city was incorporated with Baden. In World War II Heidelberg was one of the few major German cities to escape undamaged. In June, 1948, the city became the headquarters of the U.S. Army European Command. Pop. (1950) 116,488.

B. F. C.

**HEIDELBERG**, town and district, Union of South Africa, Transvaal Province. The district extends south to the Vaal River and is a part of South

## Heijo

Africa's great corn triangle. The town is 42 miles by rail southeast of Johannesburg on the edge of the great Witwatersrand gold area. Pop. (1951) 7,639, including 2,887 Europeans and 290 Asiatics.

**HEIDELBERG COLLEGE**. See COLLEGES.

**HEIDELBERG UNIVERSITY**. The Badische Ruprecht Karls Universität, in Heidelberg, Germany, was founded in 1386. To many it has been personified in fiction and light opera as the "typical German university" and it is from such mental pictures of uniformed students, saber duels, and choral singing to the accompaniment of flowing beer, that a distorted notion of German higher education has come. Before World War II, over 2,600 students were enrolled at Heidelberg under the faculties of theology, law, medicine, philosophy, and natural science and mathematics. A large number of research institutes were located at the university. In 1946 instruction was gradually resumed in the university under the direction of the American occupation forces, and a school was established there for the older children of American officials in Germany.

ROBERT MARSH

**HEIDENHEIM**, city, S Germany, in Baden-Württemberg, on the Brenz River, 30 miles by rail NE of Ulm. Its manufactures include textiles, metal goods, machinery, rubber products, and cigars. The ruined castle of Hellenstein rises above the city. Heidenheim was named early in the 12th century and became a town in 1356. Pop. (1950) 42,500.

**HEIDENSTAM, WERNER VON**, 1859-1940, Swedish writer, was born in Olshammar. Planning to be an artist, he studied painting at Stockholm Academy, but departed within a short time to travel extensively in Europe, Africa, and the East. *Pilgrimage and Years of Wandering* (1888), lyrical poems based on his observations in the Orient, initiated a revolt against naturalism. His hedonistic adoration of beauty is reflected in *Hans Alienus* (1892), an allegorical novel. *Poems* (1895) and *The Carlists* (2 vols. 1897-98), an historical novel, are marked by a strong nationalistic fervor also apparent in his other novels. In 1916 he was awarded the Nobel prize for literature in recognition of the excellence of *Nya Dikter*, a volume of lyrics published a year earlier.

**HEIFETZ, JASCHA**, 1901- , Russian violinist,



Jascha Heifetz

was born in Vilna. He received his first lessons at the age of three from his father, entering at four the Vilna Conservatory. Playing at concerts the following year, Heifetz attracted the attention of LEOPOLD AUER, whose pupil he became (1909) at the St. Petersburg Conservatory. From 1917 when he made his debut in New York City, he made his home in the United States, acclaimed as a violinist of rare ability.

FELIX BOROWSKI

**HEIGHT OF LAND**, the geographic term for the low drainage divide in Canada E of the Rocky Mountains. The divide traces an irregular course across the Canadian Shield, separating Arctic-system waters from those of the Atlantic. See DIVIDE.

**HEIJO, Pyongyang, or Pyengyang**, capital of the People's Republic of North Korea, on the Taidong River, 30 miles NE of Chinnampo, its port on Korea Bay. Heijo lies on the mainland route between China, Manchuria, and Korea. According to tradition a Chinese colony, the forerunner of the Korean nation, was founded here in 1122 B.C. The city was the scene of battles between the Japanese and Chinese in 1592 and 1894. It became the capitol of North Korea in 1948. In the Korean War U.N. forces captured Heijo in October, 1950, but Communist troops regained the city two months later. Pop. (1940) 285,965.



**HEILBRONN**, town, Germany, Württemberg, on the Neckar River, 33 miles by rail N of Stuttgart. The town has several old buildings, including the German House, Götzenturm (the tower in which Goethe allows Götz von Berlichingen to die), the town hall (1540), the church of St. Kilian (13th to 16th centuries), and the Schönthaler Hof. The town has reminiscences of Emperor Charles V, Franz von Sickingen, Georg von Frundsberg, Schiller, and the legendary Kätschen von Heilbronn, subject of the play of the same name by Heinrich von Kleist. Robert Mayer, the physicist, was born here in 1814. Heilbronn is the most important commercial and industrial town in Württemberg. Manufactures include machinery, iron and metal products, chemicals, paper, sugar and other food stuffs, silversmithing, and other luxury articles. Wine, fruit, and beer are produced and sandstone is quarried. Salt is mined in the vicinity. There is trade in leather, wood, grain, livestock, coal, and wine. The ancient mineral spring, from which the town derives its name, ceased to flow in 1857.

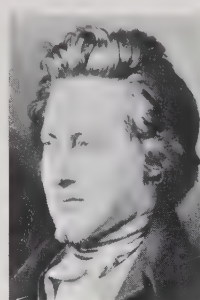
Heilbronn was the site of a Roman settlement and was mentioned as early as 741; it became a town in 1225. It took an active part in the Reformation, becoming Lutheran in 1525. It was seized by the German peasants during the Peasant War (1524-26). Here, in April, 1633, after the death of Gustavus Adolphus, the Heilbronn Alliance was formed between the Swedes under Oxenstierna and the German Lutherans, to continue the THIRTY YEARS' WAR. In World War II Heilbronn fell to the U.S. Seventh Army on Apr. 12, 1945. Pop. (1946) 52,930.

**HEILUNGKIANG**, province, China, in NE Manchuria, covering the NE section of the former province of the same name; second largest of the six new provinces created in September, 1945; area 167,326 sq. mi.; pop. (1945 est.) 2,281,025. It is separated from the U.S.S.R. on the north by the Argun River and on the northeast by the Amur River. It is bounded on the southeast by Hokiang, on the south by Sunkiang, on the southwest by Nunkiang, and on the west by Hsingan. The province is mountainous; the principal mountains are the Little Khingans, extending through the eastern and southeastern sections. It is drained by many small tributaries of the Amur, Nun (Nonni), and Albazin. Extensive forests supply the chief industry, paper manufacture. There are some paying gold mines in the mountain districts, and coal and iron are found. Though the climate is somewhat cold, millet, corn, barley, wheat, and sorghum are grown. Cattle are grazed on the rich pasture lands. The capital is Peian (Hailun); other important towns are Aigun and Lungchen.

**HEIN, MELVIN**, known as **Mel**, 1909- , American football player, was born in Reddington, Calif. A graduate of Washington State College, he won All American honors as a member of the 1930 Pacific Coast championship team that played in the Rose Bowl. Considered the outstanding center in professional football history, he played with the New York Giants 15 years (1931-45), was named on the all professional team eight consecutive years (1933-40) and voted the league's most valuable player in 1938. Head coach of football at Union College (1943-46), he joined the coaching staff of the Los Angeles Dons in 1947.

**HEINE, HEINRICH**, 1797-1856, German poet, was born in Düsseldorf, of Jewish parents. He shared his father's French sympathies and worship of Napoleon, to which he was to give expression in his famous ballad "Die Beiden Grenadiere." His uncle, Salomon Heine, a wealthy merchant in Hamburg, set him up in business there, but was soon convinced that his nephew was no businessman and sent him to the University of Bonn to study law. However, both at Bonn and at Göttingen, where he finally took his degree, he showed more interest in literature than law. This interest was stimulated

during a sojourn in Berlin, where he became closely acquainted with Chamisso, Fouqué, Hegel, and other writers. Heine's lyric genius was fully developed in his first works—*Gedichte* (1822) and *Reisebilder* (1826-27)—but his originality was not generally recognized until the publication of his *Buch der Lieder* (1827), which included his earlier poems. In his later work he often succeeded in imitating the odd, sensitive music of these *Lieder*, but his more mature poems rarely equaled them in freshness and simplicity. They have been set to music by Schubert, Schumann, Mendelssohn, and other composers, and many of them, as "Die Lorelei," "Du bist wie eine Blume," and "Auf Flügeln des Gesanges," are best known as songs.



Heinrich Heine

As the German laws excluded Jews from civil service, Heine became a Christian in 1825. He did not pursue his legal career, however, but worked for a short time as an editor in Munich. In 1830 his imagination was stirred by the July revolution in France, and he determined to support the French Liberals; in May of the next year he settled permanently in Paris. There he began to regard it as his vocation to draw France and Germany together. This was the object of his *Französische Zustände* (1833), an account of German intellectual movements from Luther to Hegel. In 1836 he published *Die Romantische Schule*, a study of German romanticism. His cynical critical attacks aroused enemies in both politics and literature, and the sale of his works was prohibited in Germany by a decree which designated him as the leader of the liberal movement, *Das Junge Deutschland*. The most important of his later works include the satires *Deutschland, ein Wintermärchen* (1844) and *Atta Troll* (1847); and *Neue Gedichte* (1844), *Romanzero* (1851), and *Letzte Gedichte und Gedanken* (1869), in which he occasionally recaptured the mood of his early lyrics. In 1845 he was attacked by spinal paresis and was an invalid from 1848 until his death. He was an erratic, romantic personality. J. J. M.

**HEINKEL, ERNST HEINRICH**, 1888- , German airplane designer and manufacturer, was born in Grünbach, Württemberg. He studied engineering at Stuttgart, and was severely injured in 1911 when his first plane crashed. He designed the World War I Brandenburg seaplane, and was the first European designer to adopt U.S. streamlining principles in the making of fast, light passenger planes. Heinkel's bombers were used by the Germans in World War II. He pioneered with jet propulsion, and his HE 280 jet fighter figured in World War II.

**HEINRICH VON MEISSEN**, surnamed **Frauenlob**, c. 1250-1318, German meistersinger, settled at Mainz after 1311, and founded there the school of MEISTERSINGERS. The most complete edition of his poems is by C. H. Müller (1843).

**HEIR**, the person upon whom the lands, tenements and hereditaments (real property) of his ancestor dying intestate devolves. Technically speaking, the word is not applied with relation to personal property, and it does not include one who takes under a will. According to the common law of England and the United States, the heir must have been born in lawful wedlock and stand in the requisite relation of CONSANGUINITY to the deceased. One cannot be the heir of a living person. He is *heir apparent*, if he possesses an indefeasible right to the inheritance should he outlive his ancestor. He is termed *heir presumptive*, if he would be entitled to the inheritance as circumstances stand, but may be eliminated by the birth of a closer heir. See DESCENT AND DISTRIBUTION; ILLEGITIMACY AND LEGITIMACY; INHERITANCE.

**HEISENBERG, WERNER**, 1901– , German physicist, was born in Duisburg and studied at the universities of Munich, Göttingen, and Copenhagen. In 1927 he was appointed professor of theoretical physics at the University of Leipzig. About 1925 Heisenberg developed *matrix mechanics*, which presented a purely mathematical model of simple atoms; see **QUANTUM THEORY**. Though successful in explaining and predicting various facts concerning the atom, its formidable mathematics has hindered its greater usefulness. In 1927 he announced his *principle of uncertainty*: there is a theoretical limit to the accuracy with which the position and velocity of any particle can simultaneously be known, and this limit is very appreciable when dealing with small particles like electrons. Heisenberg won the 1932 Nobel prize in physics. In World War II he led the unsuccessful research to produce atomic fission for the Germans. After 1945 he headed the Max Planck Institute, Göttingen, and in 1951 was appointed president of the Research Council of the West German Republic.

**HEJAZ**, one of the two component parts of Saudi Arabia, extends from Asir in SW Arabia 800 miles N to Trans-Jordan and from the Gulf of Aqaba and the Red Sea to Nejd; area 150,000 sq. mi.; population estimates range from 850,000 to 3,000,000. Hejaz is a narrow, coastal region 200 miles wide, divided from its inland plateaus and oases by mountains, whose peaks reach 7,000 feet. Wejha, Yenbo, Rabigh, and Jidda, the port of Mecca, are Red Sea ports. Numerous settlements are scattered inland, including Taima, Khaibar, Safaha, Medina, Tebuk, and Bisha. The annual pilgrimages which bring thousands of "Hajjis" to the holy cities of Mecca (pop. about 80,000), Mohammed's birthplace, and Medina (pop. about 20,000), where the prophet was buried in 632, play an important part in the commerce of Hejaz.

Products of Hejaz include wool, hides, dates, wheat, barley, charcoal, butter, honey, and fruits. Domestic animals are horses, donkeys, sheep, and camels. Oil and mineral resources are being discovered and developed to build up revenue.

**History.** In 1916, while Turkey was engaged in World War I on the side of Germany, Husein Ibn-'Ali, emir of Mecca, with British encouragement and assistance led a revolt against Turkish rule. When Husein proclaimed himself "King of the Arab Coun-

tries," open rivalry broke out between him and Ibn Saud, emir of the Nejd, who had proved less amenable to British influence. After World War I Hejaz and Nejd became independent kingdoms, but the rivalry between the two rulers quickly broke into open conflict. In spite of British support of Husein, Mecca was captured by Ibn Saud in 1924; the following year he conquered all of Hejaz and promptly proclaimed himself king of this territory. In 1927 Great Britain by treaty recognized Ibn Saud as king of Hejaz and Nejd. In 1932 the name of the combined kingdom was changed to SAUDI ARABIA. Nevertheless each component part has maintained its separate government; the capital of Hejaz is at Mecca and that of Nejd at Riyadh. In contrast to Nejd, which is an absolute monarchy, Hejaz is theoretically governed under a constitution.

**HEJIRA, HEGIRA, or HIJRA**, the flight of Mohammed from Mecca to Medina, A.D. 622. The Caliph Omar (634-44) named the Mohammedan era after this event, dating it from the first day of the year in which the flight occurred (July 16). The years, being purely lunar, are about 11 days shorter than those of the Christian era. To convert a date in the Hejira reckoning into the corresponding date in the Christian reckoning, multiply the former by 0.970224, and add 621.5774: the whole number will indicate the year, and the approximate day will be obtained by multiplying the decimal by 365.

**HEKLA, MOUNT**, a volcanic mountain (5,108 ft.) of S Iceland, 70 miles E of Reykjavik. Since the ninth century it has been in frequent eruption, although from the eruption of 1845 to Mar. 29, 1947, it was quiescent. In 1947 smoke and stones were thrown to a height of 25,000 feet, and the volcanic ash darkened all southern Iceland.

**HEL**, in the mythology of the ancient Germanic and Scandinavian races, the goddess of the lower world and of death. She was the daughter of Loki, the personification of malice, and was hurled by the All-father into the depths of Nifheim, where she ruled over those human beings who died of disease or old age. In the Middle Ages she became confounded with the kingdom she ruled over, and eventually the double conception was held to be synonymous with hell.

**HELD, ANNA**, 1873-1918, French-American actress, made her first stage appearance in London at the Princess Theater. In 1896 she came to the United States to appear in *A Parlor Match* by Charles H. Hoyt, and was an immediate success, due partly to her vibrant French technique of singing and partly to the efforts of a press agent, who publicized her milk baths. The star of numerous musical comedies, she was featured in *Papa's Wife*, *Miss Innocence*, and *The Parisian Model*. Her second husband was FLORENZ ZIEGFELD.

**HELDER, or Den Helder**, seaport, the Netherlands, on the N extremity of North Holland Province, at the outlet of the Zuider Zee, opposite the island of Texel, 50 miles NW of Amsterdam. It is protected from the sea by granite embankments five miles long and 30 feet across the top. Willemsoord, near by, is a Dutch naval station with a naval cadet school. Helder was first fortified by Napoleon in 1811. Just outside the harbor the English fleet was defeated by De Ruyter and Tromp in 1673. During World War II Helder was liberated from German rule by British troops in January, 1946. Pop. (1950 est.) 34,004.

**HELDERBERG SERIES**, a series of rocks, mainly fossiliferous limestones, found along the Appalachians from New York to Tennessee. They are from 300 to 600 feet thick in New York and Pennsylvania. They were laid down in early DEVONIAN time and are overlain by the Oriskany sandstone.

**HELEN**, heroine of the Trojan War (see **TROY**), was the daughter of Tyndareus and Leda, and sister of Pollux, Castor, and Clytaemnestra. Her surpassing

Jidda in Hejaz is the Red Sea port for pilgrims to Mecca. Street scene reveals Arabian architecture

EWING GALLOWAY







WADSWORTH ATHENEUM

**"Rape of Helen," a painting by Luca Giordano**

beauty caused suitors from all Greece to ask for her hand; but after Menelaus was chosen, PARIS bore her off to Troy, causing the Trojan War. After the capture of Troy, she returned to Sparta with MENELAUS.

**HELENA, FLAVIA JULIA**, c. A.D. 247–c. 327, the wife of Constantius Chlorus and mother of CONSTANTINE THE GREAT. She is famous for her attachment to Christianity, and her reputed discovery at Jerusalem of the sepulcher of Christ and the wood of the Cross.

**HELENA**, city, E central Arkansas, county seat of Phillips County, at the head of low-water navigation on the Mississippi River; on the Missouri Pacific, the Missouri and Arkansas, and the Illinois Central railroads; 90 miles E of Little Rock. Helena is the only river and rail terminal on the west bank of the Mississippi in the lower Mississippi Valley. It was settled in 1820 by Sylvanus Phillips and named for his daughter. Seven generals of the Confederacy had their homes in Helena. The Confederate forces were defeated here in the Battle of Helena in July, 1863. Helena has cotton gins and compresses and manufactures of cotton and cotton products, hosiery, and lumber. Pop. (1950) 11,236.

**HELENA**, city, W central Montana, capital of the state and county seat of Lewis and Clark County, on the Great Northern and the Northern Pacific railroads, U.S. highways 10 and 91, and the Southwest and Western air lines; about 70 miles NE of Butte. Helena is beautifully situated near Mount Helena and Mount Ascension in the flat, almost treeless Prickly Pear Valley, which stretches to the foothills of the Big Belt Mountains on the east and to the spurs of the Rockies on the north and west. The city is a trade center for a region which is rich in agricultural produce, in livestock, and mining activities. The principal industries include mining and

**Montana state capitol in mining town of Helena**

MONTANA C. OF C.



the manufacture of lime and concrete, brick and tile, and flour. Helena is the seat of Carroll College, the only Catholic men's college in the state. The State Historical Library in the capitol is Montana's outstanding historical museum. The city is the hub of one of the finest recreational and scenic areas in the United States. The Gates of the Mountains, where the Missouri River cuts through the main range of the Rockies, 18 miles from Helena, is a point of historic interest, having been visited and named by Lewis and Clark.

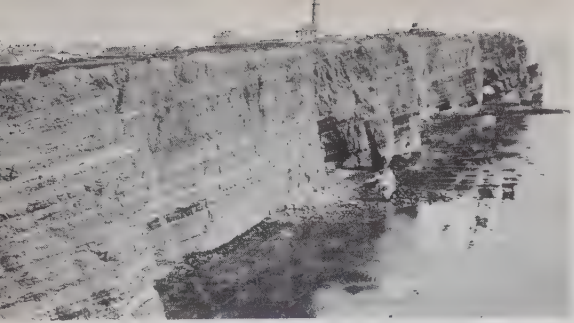
Helena owes its existence to the discovery of gold in the Last Chance Gulch, now the city's Main Street, late in the summer of 1864. The mining camp was named for Helena, Minn., the home of some of the miners. By 1875 Helena had become the capital of the Territory and a great mining center said to be the richest city per capita in the United States. When Montana entered the Union in 1889, Helena was chosen the capital. In the fall of 1935 a series of earthquakes in the city caused several deaths and property damage estimated at \$4,000,000. Pop. (1950) 17,581. A. M. K.

**HELENUS**, son of Priam and Hecuba, twin brother of CASSANDRA, famous for his prophetic powers. He fought in the Trojan War. Later stories tell that Pyrrhus took him to Epirus; and after Pyrrhus' death he married Andromache and reigned there.

**HELIGOLAND**, or **Heligoland**, German island in the North Sea, 28 miles NW of the mouth of the Elbe River; area 130 acres. It consists of Heligoland proper, a plateau whose red sandstone cliffs rise abruptly out of the sea to a height of about 184 feet, with a small beach at its southern extremity, and Dünen Insel, once a part of the main island, but separated from it by a tidal wave in 1720. Considerably larger in ancient and medieval times, Heligoland was weathered to its small size by wind and sea. In March, 1947, the face of the island was further altered by explosives set off in the hope of destroying Heligoland as a future military threat.

Its population, numbering about 2,500, spoke a dialect compounded of ancient Frisian and Danish, with a sprinkling of English and Low German. Lobster and other fisheries supplied exports, and sheep grazed on the island pastures. A fishing village occupied the lower island; in the upper town there was a biological institute, a theater, and an aquarium. The habitat of hundreds of species of migratory birds, Heligoland was of great ornithological interest. It was a popular tourist resort.

**History.** A religious center of the ancient FRISIANS, Heligoland came under Danish rule in 1714, and was ceded to the English in 1807, who in 1890 gave it to the Germans in exchange for ZANZIBAR. Because of its strategic location, Heligoland was made a naval base and sea fortress by the Germans between 1890 and 1914. Its guns protected the ports of Cuxhaven and Bremerhaven and the entrance to the Kiel Canal. In its waters an Anglo-German sea battle was fought in 1914, ending in a reverse for the German fleet. Following World War I, the military installations were destroyed according to the provisions of the Versailles Treaty, as were the huge concrete sea walls protecting the crumbling rock from the waves. Under Hitler, the island once again was transformed into a formidable fortress, and an airstrip was built on Dünen Insel. Bombed by Allied aircraft during World War II, Heligoland was captured by the British in April, 1945. In March, 1947, following the removal of the island's inhabitants and a small preliminary blast to frighten off the innumerable birds, the British exploded more than 600 tons of gelignite, torpedo war heads, depth charges and TNT, which had been placed in the island's  $8\frac{1}{2}$  miles of tunnels. A British naval expedition, landing the following day, found that all the main targets of the blast, the massive concrete submarine pens, the coastal and anti-aircraft batteries, and the underground fortifications, had



EWING GALLOWAY

## Helgoland before destruction by British in 1947

been completely shattered. The outer harbor and the sea wall were little damaged; the lighthouse, the biological institute, and some of the houses of the upper town survived. The island was expected to remain only a bird sanctuary and an occasional refuge for fishing craft. In 1951 British and German police cleared the island of squatters, alleged to be Communist-inspired demonstrators against Britain's use of the island as a practice bombing target.

**HELIAND, THE**, an old Saxon alliterative poem, of unknown authorship, written in the early part of the ninth century, the subject being the Savior. It was edited by Heyne in 1907.

**HELIANTHUS**. See **SUNFLOWER**.

**HELICAL GEAR**. See **GEAR AND GEARING**.

**HELICON**, a mountain range (5,736 ft.), ancient Greece, in SW Boeotia, celebrated as the favorite seat of the MUSES. At the foot of the range stood the village of Ascra, the residence of Hesiod, and the seat of the earliest school of poetry in Greece.

**HELICOPTER**. See **AERONAUTICS**.

**HELIODORUS**, fl. third century A.D., writer of Greek romance, was a Syrian. The work by which he is known is entitled *Aethiopica*, in 10 books, narrating in poetic prose the loves of Theagenes and Chariclea. It is the earliest of extant Greek romances.

**HELIOGRAPH**, an instrument used for signaling by flashing the sun's rays from the face of a mirror. If the mirror is vertically below the sun, or between it and the receiving station, a second mirror must be used to direct the sun's rays on to the face of the first. If the mirror is directed exactly at the required spot, its flashes cannot be read more than 10 yards on each side of the latter when the distance is a mile, or 50 yards if two miles. The mirrors, sighting vane, and other mechanism for adjustment are mounted on a tripod. Communication has been established over 215 miles. See **SIGNALING**.

**HELIOLITES**, a genus of fossil corals of rounded massive form with radiating tubes, found in Palaeozoic rocks ranging from Ordovician to Devonian.

**HELIOPOLIS**, Egypt, the Greek name of the city called by the Egyptians *On*, situated on the E side of the Pelusiac branch of the Nile, near the apex of the delta. It was one of the learned and important cities of ancient Egypt. It was the chief seat of the wisdom of the Egyptians; and Thales, Plato, and Solon are reported to have learned from its priests. The OBELISK known as "CLEOPATRA'S NEEDLE" taken in 1878 to England, and the one taken to New York in 1880 were originally transported to Alexandria from this city. The Syrian BAALBEK was also known to the Greeks as Heliopolis.

**HELIOS**, the god of the sun in Greek mythology, was the son of Hyperion and Thea, and is himself often called Hyperion. Greek poetry describes him as starting from a splendid palace in the east, and traversing the sky in a chariot drawn by four horses, to arrive at another palace in the west. His worship was common throughout Greece, particularly in Rhodes, where the famous COLOSSUS was a representation of him. In later times he was identified with APOLLO.

**HELIO THERAPY**. See **SUN BATH**; **ULTRAVIOLET RADIATION**; **PHYSICAL THERAPY**.

**HELIOTROPE**, *Heliotropium*, a genus of plants belonging to the family *Boraginaceae*. They are hardy outdoor annuals and cultivated greenhouse shrubs. The most commonly cultivated species is *Heliotropium peruvianum*, a small shrub with hairy rugose leaves and trusses of lilac-tinted fragrant flowers. It grows to a height of two or more feet and blooms freely until killed by frost. Heliotrope is popular as a pot plant and should be grown in a moderately cool airy house. Stout cuttings make the best plants. A light rich soil and plenty of moisture are the chief requirements. The seaside heliotrope, *H. curassavicum*, grows wild on sandy shores in the southern United States.

**HELIOTROPE**. See **BLOODSTONE**.

**HELIOTROPISM**. See **PHOTOTROPISM**.

**HELIUM**, a chemical ELEMENT belonging to the INERT GASES. Its symbol is *He*. Under ordinary conditions helium is a colorless odorless gas. It is the second lightest of the elements, hydrogen being the lightest. Helium will not combine chemically with any other element and is, therefore, incapable of exploding or burning. These properties make helium especially suitable for filling BALLOONS and dirigible airships. Since the explosion of the hydrogen filled dirigible, *Hindenburg*, in 1937, helium has virtually replaced hydrogen gas for this purpose. Helium has 92 per cent the lifting power of hydrogen. During World War II helium was used not only for filling lighter-than-air craft (used against submarines) but by inflating tires of bombers and other planes, the Air Forces were able to save the difference between 180 pounds of air required for this purpose and 26 pounds of helium required for the same purpose. Helium filled balloons also enabled the weather bureau to record stratospheric conditions. Another war use of helium was in metallurgy, as an inert atmosphere in welding magnesium aircraft parts.

The atomic weight of helium is 4.003; its atomic number is 2; its density is 0.177 g. per liter. It liquefies at the boiling point, 4.216°K., the lowest of any element. The only element to remain liquid at ABSOLUTE ZERO, it solidifies only by pressure. It freezes at 1°K. under 25 atmospheres.

The discovery of helium dates back to an eclipse of the sun in 1868 and is credited to both the French astronomer JANSSEN and the British scientist Sir JOSEPH NORMAN LOCKYER. A bright yellow line was detected in the solar flash spectrum which could not be associated with the spectrum of any element then known. The name helium was derived from the Greek word *helios*, "the sun." It was not until 1894 that Sir WILLIAM RAMSAY detected its existence on earth.

Helium constitutes about 1 part in 185,000 (by volume) of the atmosphere. It occurs in certain rocks and minerals, chiefly those containing the radioactive elements thorium and uranium. Despite its name, the helium now on earth did not come from the sun, but through neutralization of ALPHA RAYS emitted by radioactive elements; see **RADIOACTIVITY**. Knowing the rate of decomposition of these elements, geologists can calculate the age of the rocks. Small amounts of pure helium gas are found in gases from mineral springs and in sea and river water, but

## Helium is the one safe gas for filling balloons

GOODYEAR





the principal source is certain natural gas wells.

The United States has a virtual monopoly of helium. Under the Helium Act, the U.S. Bureau of Mines is charged with the responsibility for production and distribution of helium in the United States. This includes shipments to military agencies and sales for medical, scientific, or commercial purposes. U.S. production of helium in 1948 (all of it from the Exell, Texas, plant) exceeded 63,000,000 cubic feet. The Exell plant extracts helium from natural gas produced for commercial purposes in the Panhandle gas field.

Congress has set up restrictions on the exporting of helium from the United States. Very little if any helium is produced from natural gas any place outside the United States.

The liquefaction of helium was first accomplished in 1908 by KAMERLINGH ONNES of Leiden. There are two varieties of liquid helium. Liquid helium II exists only below 2.2°K., and exhibits peculiar phenomena. It forms surface films of apparently zero viscosity, which cause the liquid to "creep" in and out of solid vessels, and to flow upward through a capillary towards a higher temperature. Its extraordinarily high heat conductivity is due to wave propagation of heat, similar to that of sound, and known as "second sound." The rare isotope He<sup>3</sup> forms only 0.0001 per cent of natural helium, but enough has been synthesized to liquefy and freeze. It does not form a superfluid II variety. R. L.

**HELIUM THERAPY.** Helium owes its physiological actions exclusively to its physical properties, including its extreme lightness, its slight solubility in blood plasma, and its high rate of diffusion. Because of these properties helium is used to replace nitrogen in air pumped to deep divers. Even at high pressures helium does not dissolve in the blood to any great extent, and therefore its use prevents DECOMPRESSION SICKNESS.

Since helium is a gas of low density, the pressure required for the passage through an orifice of the helium-oxygen mixture is only about one-half that required for the passage of air. Thus helium is highly beneficial in all cases of partial obstruction of the respiratory tract, in severe prolonged asthma, in inflammatory obstructions of the air passages, and during anesthesia in patients with the windpipe compressed by adjacent growths. Because helium facilitates the exchange between the air in the lungs and the inspired gases and because oxygen diffuses more readily through helium than through nitrogen, the administration of helium-oxygen mixtures often leads to a dramatic relief in many asthmatics who do not respond to drug therapy. After the patients recover, at least partially, following the inhalation of this gas mixture, they frequently regain their responsiveness to the standard antiasthmatic remedies. Many physicians claim that the inhalation of oxygen without nitrogen is as beneficial as helium-oxygen in treatment of severe asthma. A. EARL VIVINO

**HELL**, the final abode or condition of those who are condemned to eternal punishment for their sins. The Christian conception of hell has its origin in the Jewish and heathen concept, which greatly influenced the development of Christian theology regarding the fate of "the lost" in the hereafter. Hell, as presented in the King James version of the Bible, involves the interpretation of two Hebrew words, *Sheol* and *Gehenna*, and two Greek words, *Hades* and *Tartaros*.

The Old Testament *Sheol* and the New Testament *Hades* were thought to be a place which was the destination of good and bad alike, where the departed souls existed in a dim, shadowy region in an inactive state.

*Tartaros*, which appears in the New Testament only as a verbal form (II Pet. 2:4), was the name given to the locality beneath Hades where, according to Homeric poems, insurgent supernatural beings were confined. The writer of II Peter uses the word ac-

curately, for he applies it to the abode of fallen angels. This conception of hell has little to do with New Testament ideas and is more in harmony with the teaching of Jewish apocalyptic books, such as the Apocalypse of Baruch and Enoch.

*Gehenna*, which appears in the Apocrypha and the New Testament, more nearly approaches the modern theological concept of hell as a place of suffering. However, the references to it in the New Testament writings are vague and have little in common with



"Hell," engraving by Blake for Dante's "Inferno"

the conception presented in some of the apocryphal writings and in the savage imagery of medieval theology, such as the tortures depicted in Dante's *Inferno*.

Although the biblical concept of hell is not perfectly uniform, in general it may be said hell is presented as a place of suffering and loss which is the inevitable doom of the sinful. This is the theological position taken by most of the orthodox branches of the church, although the Roman Catholic church has added the doctrine of PURGATORY as an intermediate state between death and heaven, where believers who die in sin go for purification before entering heaven. Most Protestant sects repudiate this doctrine.

According to the doctrine of Universalism, which goes back to the teachings of ORIGEN, no sinner is consigned to eternal punishment. Hell is purgatorial in character, and punishment ceases as soon as the sinner has been purified. According to this theory, everyone will ultimately be saved.

Another view of hell is the doctrine of *Conditional Immortality*, according to which complete destruction and not endless suffering is the doom of sinners. According to this theory, immortality is only to be obtained as the free gift of God, since the soul is by nature mortal.

A popular conception of hell, which has been held by many Christians, has been one in which the punishment of the condemned is accomplished by fire and brimstone. Such a literal picture of hell has given way in the minds of many of the more liberal, as well as some of the more orthodox, Christians to a concept of hell as the disastrous consequences which naturally and inevitably follow sin in any form. The modern trend has been to replace the traditional, materialistic belief in hell as a place of physical suffering with a belief in hell as a condition of spiritual distress necessary for the purification from sin. See HEAVEN; HADES. W. G. D.

**HELL GATE**, a narrow portion of the EAST RIVER, New York, between Long Island and the upper part of Manhattan Island, and on both the east and west sides of Ward's Island. Strong tidal currents and rocks made navigation here difficult and dangerous. In 1852, 1876, and 1885 the U.S. government blew up some of the most dangerous rocks, and continued dredging and rock removal has provided a safer channel. See NEW YORK, city.

**HELLAS**, the name given by the ancient Greeks to their country as a whole, including all lands inhabited by Hellenes, from Sicily to Marseilles in the west to the Black Sea in the east. In Homer the terms Hellas and Hellenes are confined to a particular district of Thessaly and its inhabitants. It is difficult to understand how the name was extended to the whole Greek people. The name came into use during the seventh century B.C. It never denoted a political union.

**HELLBENDER**, an unusually large and ugly salamander found among the vegetation and rocks of the rivers of central and eastern United States. The hellbender, *Cryptobranchus alleganiensis*, measures 18 inches or more in length and in color is brown with darker irregular markings. It has short legs, small eyes without lids, a laterally compressed tail, and a flattened head. Its loose, wrinkled skin is thick and slimy. Entirely aquatic, the hellbender breathes through its skin. Food consists of fishes and worms, the animal often annoying fishermen by stealing the bait from their hooks. The breeding habits are like those of fish. The male hellbender scoops out a nest in the floor of the river and waits until the female approaches to deposit eggs. After fertilizing the eggs he remains to guard them until they are hatched.

**HELLE**, in Greek mythology, the daughter of Athamas and Nephele, king and queen of Thessaly. Athamas, tiring of his wife, put her away and took another, whereupon Nephele fearing danger to her children from their stepmother, set them on the ram with the golden fleece, who fled with them over the sea. In crossing the strait between Asia and Europe, Helle fell into the sea and was drowned. The strait was called Hellespont in her honor. The modern name of this historic waterway is the DARDANELLES.

**HELLEBORE**, also called **Christmas Flower**, a common perennial herb belonging to the family *Ranunculaceae*. Hellebores, *Helleborus viridis*, are naturalized from Europe and grow wild in eastern United States. They have palmate leaves and large nodding flowers. Another species, *Veratrum viride*, called false hellebore, belonging to the family *Liliaceae*, is pubescent, with poisonous roots and unattractive flowers. It is used in making a powerful blood-pressure-depressing drug, **VERATRUM VIRIDE**.

**HELLEN**, in Greek tradition the ancestor of the race, was the son of Deucalion and Pyrrha, or of Zeus and Dorippe. He was king of Phthia in Thessaly.

**HELLENISM**, Greek civilization considered in its entirety. Five Hellenistic periods are commonly distinguished: the culture which existed before the fourth century B.C.; cosmopolitan, or Alexandrian Hellenism, following the death of Alexander (323 B.C.); Greco-Roman Hellenism, which prevailed from the second to the fifth century of the Christian era; Byzantine Hellenism, which languished under Turkish domination and found belated expression in the Renaissance; and Modern Hellenism, the cultural revival which accompanied the political resurgence of Greece in the 19th century. In its most special sense, Hellenism refers to the colonial civilization of the Age of Alexander, when Greek culture dominated the Mediterranean, the Near East, and northern Africa. See **ALEXANDER THE GREAT**.

With the advent of Christianity, Hellenism, particularly in the form of **NEO-PLATONISM**, came to represent pagan reaction against the new philosophy. Under Julian the Apostate, Greek culture assumed the character of a state religion. With the rise of the Eastern Empire in the fifth century, it was gradually assimilated by the Greek church and, spreading through eastern Europe, took firm root in the Slavic countries. See **BYZANTINE ART**; **RENAISSANCE**.

**HELLESPOINT**. See **DARDANELLES**.

**HELL'S CANYON**. See **SNAKE RIVER**.

**HELLEU**, **PAUL**, 1859-1927, French dry-point artist, was born at Vannes. He studied dry-point work under James Tissot, and was especially successful in his portraits of women and children.

**HELLGRAMMITE**. See **CORYDALIS**.

**HELLMAN**, **LILLIAN**, 1905- , American playwright, was born in New Orleans, La., and educated at New York and Cornell universities. After a time as a newspaper book reviewer, she wrote *The Children's Hour* (1934), and devoted herself thereafter to writing for movies and theater. Her other works include *The Little Foxes* (1939); *Watch on the Rhine* (1941); *The Searching Wind* (1944); and *The Autumn Garden* (1951).

**HELMAND RIVER**, Afghanistan, rises on the S of the Koh-i-Baba some 35 miles W of Kabul. It flows for about 600 miles in a southwesterly direction, receiving numerous tributaries, and empties into the swampy Hamun depression in the southwestern part of Afghanistan. The river furnishes power at a number of points along its course.

**HELMET**. See **ARMOR**.

**HELMET SHELL**, a genus of marine gastropod mollusks in which the massive shell frequently consists of differently colored layers, and is therefore used for carving shell **CAMEOS**. The species most used is the large helmet, *Cassis madagascarensis*, sometimes almost a foot long with a white outer and brown inner layer. Most of the helmet shells come from hot regions.

**HELMHOLTZ**, **HERMANN VON**, 1821-94, German physiologist and physicist, was born in Potsdam and educated in Berlin. He was appointed professor of physiology and general pathology at the University of Königsberg (1849), later taught at Bonn, Heidelberg, and Berlin, and became president (1888) of the Imperial Physico-Technical Institute at Charlottenburg. Helmholtz formulated the theory for the conservation of energy (1847), and gave new direction to the studies of seeing and hearing, writing standard texts in each field. His study covered almost every science, and he became one of the most distinguished scholars of his time. In 1851 he invented the ophthalmoscope, which enabled him to be the first to examine the interior of the living eye. Other fields he investigated included: binocular vision, color vision, eye focusing, physiology of the inner ear, studies in pitch and timbre, melodic relations of tones, and methods for measuring the rate of nerve-impulse transmission. With **WILHELM WUNDT**, he is regarded as the founder of experimental psychology. See **EAR**; **COLOR BLINDNESS**.

**HELMOND**, town, Netherlands, in the province of North Brabant; 28 miles SE of s'Hertogenbosch. The chief industries are ironworks, tobacco factories, and textile works. Pop. (1954 est.) 38,678.

**HELMONT**, **JAN BAPTISTA VAN**, 1577-1644, Flemish physician and chemist, was born in Brussels and studied at the University of Louvain. From 1609 Helmont lived at Vilvorde near Brussels. He is known as the founder of pneumatic chemistry, because he was the first to use the term gas for the various aeriform fluids having the physical qualities of atmospheric air. Among his discoveries was carbonic acid whose gaseous form is carbon dioxide. His works were published posthumously as *Ortus Medicinae* (1648).

**BIBLIOG.**—H. E. Sigerist, *The Great Doctors* (1933).

**HELODERMA**. See **GILA MONSTER**.

**HELOÏSE**. See **ABÉLARD**.

**HELOTS**, the serf population of Laconia and Messenia in ancient Greece. They formed the lowest class in the Spartan state, and were the property of the state, not of individuals. They were, however, assigned to cultivate the lands of individual Spartans, and paid the owners a certain part of the produce; the remaining part being their own property. Any Spartan could at any moment call on a helot to perform any service for him. In war they served as light-armed troops; and for good service might be rewarded with their freedom. But they were a constant danger to the state; and in 464 B.C. a general revolt occurred, which, after a war lasting several years, the Spartans put down only with great difficulty. See **SPARTA**.





Castle of Kronborg at Helsingør, Denmark

**HELPER, HINTON ROWAN**, 1829–1909, American author, was born near Mocksville, Davie County, N.C., and educated in the South. He became famous as the author of *The Impending Crisis in the South, and How to Meet It*, published in 1857, which was an economic argument against slavery. He was consul at Buenos Aires in 1862–66, and afterward projected the “Three Americas Railway,” to connect Bering Strait with the Straits of Magellan. His other publications include *The Land of Gold* (1865); *The Negroes in Negroland, the Negroes in America, and the Negroes Generally* (1868); *The Three Americas Railway* (1881).

**HELSINGBORG.** See **HALSINGBORG**.

**HELSINGFORS.** See **HELSINKI**.

**HELSINGÖR**, or **Elsinore**, town and seaport, Denmark, in Frederiksborg County, on the Sound (Oresund) opposite Halsingborg, Sweden. East of the town is the imposing fortress of Kronborg (built in 1574), where Denmark collected Sound tolls levied on passing ships from 1425 to 1857. The fortress is reputed to be the castle of Shakespeare's *HAMLET*. Shipbuilding and repairing, glassmaking and textile weaving are important industries of the town. Pop. (1945 est.) 18,000.

**HELSINKI**, or **HELSINGFORS**, seaport, capital, and largest city of Finland, in the department of Uusimaa (Nyland), situated on the Gulf of Finland, about 250 miles W of the city of Leningrad in the U.S.S.R. The heart of Helsinki is the market place facing the harbor. The square is surrounded by the Town Hall, the residence of the president, the Supreme Courts of Justice, and by several foreign legations. Other features of interest in the city include the cathedral of St. Nicholas, the imposing railway station designed by Eliel Saarinen, an observatory, and the Parliament building. As the foremost cultural center of Finland Helsinki is the seat of the national university, the Athenaeum, the national art gallery, a polytechnic school, the National Museum, the Finnish National Theatre, and the Opera House.

Although for several months each year the ice on the Gulf of Finland prevents shipping at Helsinki, the city does a considerable trade in pulp and paper, timber, and livestock. It is the principal industrial center of the country, manufacturing metal goods, beer and spirits, and tobacco. Pop. (1949) 381,476.

Helsinki was founded by Gustavus Vasa of Sweden in the 16th century near the present site, to which it was removed in 1640. It was burned by the Russians in 1713, was later refortified as a military and naval base, and eventually fell, with the rest of the country, into Russian hands in 1809, becoming part of the Russian Empire. Three years later it was made the capital of the Grand Duchy of Finland. The city was the scene of a serious mutiny in 1906. Though it was repeatedly bombed during the Russo-Finnish War of 1939–40, the capital remained in Finnish hands. During the second Russo-Finnish War (1941–44) it was again subjected to heavy bombing attacks. It

escaped, however, with comparatively slight damage to its principal public buildings.

**A. M. K. HELST, BARTHOLOMEUS VAN DER**, 1613–70, Dutch painter, was a founder of the Guild of St. Luke (1654) with Nicolas Stokade. His most famous picture, “The Banquet of the Civic Guard” or “The Peace of Münster,” contains 24 full-length portraits and shows the influence of Frans Hals. Among his other paintings are “Syndics of the Brotherhood of St. Sebastian” and “Syndics of the Marksmen.”

**HELVETIA.** See **SWITZERLAND**.

**HELVETIC REPUBLIC.** See **SWITZERLAND**.

**HELVETII**, a Celtic nation who lived between the Jura Mountains, the Lake of Geneva, the Rhone, and the Rhine as far as Lake Constance. In 107 B.C. they routed a Roman army on the Lake of Geneva; in 101 they invaded Italy with the Cimbri; in 58 they endeavored to invade Gaul, but were forced back by CAESAR. Later they were Romanized. Consult Caesar's *De Bello Gallico*.

**HELVÉTIUS, CLAUDE ADRIEN**, 1715–71, French philosopher, one of the Encyclopedists, was born in Paris. He was appointed farmer-general of the taxes (1738), but resigned to become chamberlain to the Queen. He later withdrew to a small estate at Voré and became associated with Diderot, D'Alembert, and Holbach. In 1758 appeared his *De l'Esprit* (Eng. trans., 1759), in which he travesties Locke, teaching that sensation is the source of all intellectual activity, and that the prime motive of human conduct is self-interest. The work was condemned by the Sorbonne, and ordered to be burned.

**HEMANS, FELICIA DOROTHEA BROWNE**, 1793–1835, English poet, was born in Liverpool. Her first notable work, *Domestic Affections, and Other Poems*, was published in 1812, the year of her marriage to Captain Alfred Hemans. Following her separation from Hemans in 1818, she published *The Sceptic* (1820), *Lays of Many Lands* (1825), *Songs of the Affections* (1830), and many other volumes of facile, sentimental verse. Her work was unusually popular in America, especially such ballads as “Casabianca” and “The Landing of the Pilgrims.”

**HEMATITE**, a common mineral composed of ferric oxide,  $\text{Fe}_2\text{O}_3$ , and containing when pure 70 per cent IRON and 30 per cent oxygen. Hematite is the most important and abundant ore of iron. Commercial hematite ores usually contain about 50–55 per cent iron. Hematite occurs widely distributed. In the United States vast beds of the ore are found in the Archaean rocks of northern Michigan, northern Wisconsin, and Minnesota. The Mesabi Range, northwest of Duluth in Minnesota, furnishes the most important deposit of hematite. This ore contains about 55 per cent iron and is mined in open pits by huge steam shovels. In other localities the ore is generally underground. Important hematite deposits of later geologic age occur in New York, Pennsylvania, Alabama, and Tennessee. Important deposits also occur in Wyoming and in southeastern Missouri. Valuable deposits of hematite are found in the Ruhr district of Germany, in Sweden, northeastern England, Spain, and France.

#### Market place facing the harbor in Helsinki

SUOMEN-MATKAT



When crystallized, hematite occurs in bright metallic crystals, steel gray in color and rhombohedral in form. The crystals are often flat and platelike, or reduced to small imperfectly formed scales (sp gr = 5.26;  $h = 5\frac{1}{2}$ – $6\frac{1}{2}$ ). This variety is known as *specular iron ore*, from its brilliant metallic luster. A variety sometimes called *red hematite* or *kidney ore* is made up of aggregates of imperfect crystals in compact columnar, fibrous, and radiating masses. This variety is dull red in color, with a submetallic or dull luster. An impure earthy hematite, the chief impurity being usually clay, is known as *red ochre*. It is used as a paint pigment and for cutting and polishing glass. E. M. W.

**HEMATOXYLIN**, the coloring principle extracted from the heart of LOGWOOD. It forms white to yellow crystals that are slightly soluble in cold water. It has the formula  $C_{16}H_{14}O_8$  and is phenolic in character. It is much used in microscopy as a nuclear red stain. See STAINS.

**HEMET**, city, S California, Riverside County, near the San Jacinto Mountains; on the Santa Fe Railroad, about 90 miles ESE of Los Angeles in a fruit-growing region which specializes in oranges, apricots, and peaches. The city has fruit and vegetable canneries, walnut and orange packing plants, seed cleaning plants, hatcheries, and nurseries. The region was once occupied by many Indian villages; Pahasnah, one of the largest, is a marked site. Pop. (1950) 3,386.

**HEMICHORDATA**, a subphylum of the phylum CHORDATA, consisting of about 70 species of small, fragile, little known, burrowing marine animals, wormlike in appearance, but distantly related to the vertebrates. The acorn worms, as they are called, are often brightly colored. They live in U-shaped burrows, in either sand or mud, which are lined with a mucous secretion. The worms give off a strong iodoform-like odor. Hemichordata are world-wide in distribution and, though sometimes found at considerable depths, are most common in shallow water. One species is relatively abundant along the Atlantic Coast.

The Hemichordata are of particular interest because they possess the notochord, dorsal tubular nerve cord, and pharyngeal gill slits of the chordates, but develop from a top-shaped larva, known as a *tornaria*, distinctly like the larvae of certain marine invertebrates, especially some of the echinoderms. Because of this combination of characteristics, the Hemichordata are considered the nearest of all living animals to the ancestral type from which the phylum Chordata evolved.

Each acorn worm has a proboscis with which it burrows into the sand. The proboscis is separated by a deep constriction from the collar. The collar is followed by a slender body in which there are paired gill slits. These slits vary in number from 10 to 700 pairs, depending upon the species and the age of the individual.

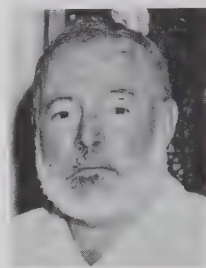
JOHN D. BLACK  
**HEMIMORPHITE**, a valuable ore of zinc, formed by the oxidation of other zinc minerals. Chemically it is the hydrous silicate of zinc with the formula  $Zn_4Si_2O_7(OH)_2 \cdot H_2O$ . In color it may be white, with sometimes a faint bluish or greenish cast, or yellow or brown. The crystals, which are transparent or translucent, are rhombohedral and hemimorphic. From this latter fact is derived the name *hemimorphite*, now favored by mineralogists. It also occurs in massive, mammillary, stalactitic, and granular forms. A fine crystalline form of hemimorphite is found in New Jersey, Pennsylvania, and Virginia, while both the crystalline and mammary forms occur in Missouri, Montana, and Utah.

Miners in general apply the name "calamine" to both the mineral described here and another ore, the carbonate of zinc, properly called, at least in America, SMITHSONITE.

**HEMING**, or **HEMMINGE**, JOHN, d. 1630, English actor, supposed to have been born in Shot-

tery, Warwickshire. He was a fellow player of Shakespeare and, with Henry Condell (d. 1627), was joint editor of the first collected edition of Shakespeare's plays. He was manager of the king's company of players and part proprietor of the Globe and Blackfriars theaters. See GLOBE THEATER.

**HEMINGWAY, ERNEST MILLER**, 1898– , U.S. writer, was born in Oak Park, Ill., educated in the public schools, was a reporter briefly for a Kansas City newspaper, and during World War I drove an ambulance on the Italian front. Most of his later life was also spent in vigorous, active, often violent pursuits as a soldier, war correspondent, big-game hunter, and deep-sea fisherman. Out of his experience he developed the main theme of his fiction: that human beings are most alive acting physically, instinctively and stoically while enduring injury. Living in Paris after World War I, and influenced by Gertrude Stein and Ezra Pound, he polished the terse, economical prose style and clipped rendering of speech which became widely copied Hemingway trademarks. His first novel, *The Sun Also Rises* (1926), a story of young, expatriate Americans living in Europe is a major effort; his second, *The Torrents of Spring*, published the same year and written chiefly as a parody of Sherwood Anderson, is one of his least effective works. His third novel, *A Farewell to Arms* (1929), a story of love and war, reflects his Italian service. It was during this early, formative period as a writer that he also produced most of his short stories. Collected in *The Fifth Column* and the *First Forty-nine Stories* (1938), they are considered by many as surpassing the quality of even his best novels. From time spent in Spain he wrote *Death in the Afternoon* (1932), a rambling disquisition on bullfighting; a play, *The Fifth Column*, and a novel, *For Whom the Bell Tolls* (1940), both of which deal with the struggles of anti-Fascists during the Spanish Civil War. Hunting in Africa produced the experimental *Green Hills of Africa* (1935), but for 10 years beginning with the advent of World War II he wrote little. In 1952, however, his novella, *The Old Man and the Sea*, a story of the acceptance of defeat, was greeted with universal acclaim and for it he received the 1953 Pulitzer prize for fiction. In 1954 he was awarded the Nobel prize for literature.



UNITED PRESS

Ernest Hemingway

**HEMIPLEGIA** is a PARALYSIS of one side of the body. It develops from some disease of or injury to a portion of the brain or the major nerve fibers which connect the brain with one side of the body. Hemiplegia is frequently caused by CEREBRAL HEMORRHAGE but can result from tumors or other conditions.

**HEMIPTERA**. Although the term "bug" is frequently applied to any kind of insect, it rightly belongs only to the members of the order Hemiptera, or true bugs. These common insects are cosmopolitan, there being numerous species of both free-living and parasitic forms. The typical bug has four wings, a pair of partially thickened forewings and a pair of membranous hindwings. Since the basal halves of the forewings are thickened and cover the hindwings when the bug is at rest, these wings are often referred to as *hemelytra* or wing covers. The beak is located on the front of the head and is equipped for piercing. An effective sucking or pumping organ is supplied by the modified pharynx. Metamorphosis of this insect is gradual; the newly hatched young closely resemble the adult but lack wings. After several molts, wing buds are formed. These continue to increase in size with successive molts until the adult form is reached.

Bugs may be found in practically any habitat. Many species, like the lace bugs and CHINCH BUGS, are





L. W. BROWNELL

Water hemlock, above; drawing of sections, below



U. S. FOREST SERVICE

terrestrial, living on plants; some, such as the water bugs and water scorpions, are wholly aquatic; others, like the shore bugs and water measurers, may live partly on land and partly in the water. Most bugs protect themselves by giving off foul-smelling substances, the stink bugs being particularly notable in this respect. Among the well-known parasitic forms annoying to man are the BEDBUGS and ASSASSIN BUGS. See HOMOPTERA.

**HEMLOCK**, a poisonous plant commonly found throughout the United States, belonging to the family *Umbelliferae*. Hemlocks are biennials with spotted stems, white flowers, and decomposed leaves. Some species grow in wet, swampy places, as the water hemlock, *Cicuta maculata*, while others, like the common hemlock, *Conium maculatum*, are found in coastal wastelands. All poison hemlocks contain a poisonous alkaloid, *coniine*, obtainable from the fruits and leaves. The poison produces extreme muscular weakness, then paralysis of the lungs, and finally death. Hemlock poisoning was a means of capital punishment for state prisoners in ancient Greece.

**HEMLOCK TREE**, a handsome, graceful, ever-green tree, *Tsuga*, occurring in rocky woods in the cool or mountainous regions of North America. There

## Hemophilia

are several species, some of them Asiatic. The common hemlock in the northeastern United States and Canada is *T. canadensis*. Other species are the *T. caroliniana* found in Virginia, the Carolinas, and Georgia, *T. mertensiana*, found in the extreme western United States, and *T. heterophylla*, a large handsome tree of the Pacific Coast having tough and durable wood. The foliage is very light in aspect, small, linear leaflets spreading in a flat spray, dark green above and silvery below; the cones are small, numerous, and dependent. When young, the hemlock presents an almost perfect pyramidal growth, the slender, horizontally spreading branches sweeping thickly and gracefully from the "leader" to the ground. In spring, the young growing twigs curve outward, soft in texture, and pale green in tint, giving a characteristic look to the tree. Hemlocks grow rapidly, and attain a great height, becoming very ragged and picturesque when old; the gray bark splits off, and many stubs of branches remain. The wood is soft, splintery, light red in hue, and in most species is used only for sheathing and interior building purposes, as it warps when exposed. The bark is used for tanning leather. See TANNIN.

**Western Hemlock** branch, right; eastern hemlock, below

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MD. FORESTRY DEPT.

**HEMOGLOBIN**. See BLOOD.

**HEMOPHILIA**, a rare disease which has afflicted especially many members of royal families. It is an inherited disease in which even a slight cut may cause fatal bleeding. Such a "bleeder" is subject to repeated and prolonged hemorrhage because the blood does not clot quickly enough to stop bleeding even from minor scratches and bruises. (See BLOOD CLOTTING.) Hemophilia affects only males, but is inherited by them from their mothers; geneticists call



defects inherited in this way sex-linked recessive characters (see HEREDITY). The daughter of a man who has hemophilia will not be a "bleeder," but half of her sons may be "bleeders," and all of her daughters will be capable of transmitting the defect to their sons. No cure has yet been discovered, though blood transfusions give temporary relief, and some of the new products obtained from fractionation of blood may prove even more effective. See BLOOD PLASMA FRACTIONS.

**HEMORRHAGE.** See BLEEDING; HEMOSTATICS; BLOOD CLOTTING; HEMOPHILIA; PURPURA; MENSTRUATION; CEREBRAL HEMORRHAGE.

**HEMORRHOIDS, or PILES,** are VARICOSE VEINS at the lower end of the rectum. This painful and annoying condition results from increased pressure in the veins, which is commonly caused by pregnancy, chronic constipation, or the necessity to stand for long periods. Occasionally, especially in men beyond middle age, it may be caused by cancer of the rectum. Hemorrhoids that originate near the anus and are covered with skin are said to be *external*; those that originate within the rectum and are covered with mucous membrane are said to be *internal*, though they may protrude through the anal opening. Neglected hemorrhoids may lead to frequent hemorrhages, with consequent anemia; to PHLEBITIS; and to thrombosis, with the attendant possibility of circulation of an infected embolus (see THROMBOSIS AND EMBOLISM). Early treatment is recommended to prevent any of these serious complications. Frequently the hemorrhoids can be healed without surgery, but advanced cases may require surgical removal or injection of a solution containing an irritant substance to obliterate the vein.

**HEMOSTATICS** are drugs used to arrest hemorrhage. See BLEEDING; BLOOD CLOTTING.

**Styptics.** Remedies used to check small hemorrhages by local application are called styptics. They include solid alum or dried alum (aluminum potassium sulfate or ammonium alum sulfate), silver nitrate sticks, ferric chloride, ferric sulfate, 1 per cent quinine and urea hydrochloride, 2 per cent acetic acid, 2 per cent hydrochloric acid, 5 per cent tannic acid, 4 per cent cocaine hydrochloride, 10 per cent sodium chloride, and very cold water or ice. Most of these substances act either by precipitating protein which seals the injured blood vessel, or by constricting the lumen of the vessels. See ASTRINGENTS.

**Thromboplastic Substances** are break-down products of blood cells or damaged tissues that aid the conversion of prothrombin into thrombin (see BLOOD CLOTTING). Impure brain extracts of cattle or other mammals are the most widely employed thromboplastins. They are either dangerous or ineffective when administered by injection, and so are usually employed only in the treatment of scar tissues, in nose-bleed, and in the surgery of the bones, nose and throat or other accessible bleeding surfaces. Many physicians question the value of thromboplastic substances since any injured tissue furnishes these in abundance, even in bleeders.

**Thrombin,** a naturally occurring substance essential for clotting, speedily produces firm clots of the blood and plasma and thus finds a wide application in the control of capillary bleeding. Bovine blood is a plentiful source of thrombin which can be highly purified so as not to cause allergic reactions in patients sensitive to certain beef proteins. Thrombin is prepared from animal or human blood (see BLOOD PLASMA FRACTIONS). When applied to a bleeding point with a cotton pledget it will almost always stop the hemorrhage, but bleeding frequently recurs when the cotton is removed, because it takes the clot with it. An absorbent material that can be left in place is, therefore, needed to obviate this difficulty. Such a material has been made from human fibrinogen. This product, known as "fibrin foam," is a whitish and fairly spongy material. It is absorbent and shrinks

somewhat in volume when wet. Suitable fragments saturated with thrombin may be applied to bleeding surfaces. Fibrin foam saturated with thrombin may control bleeding in brain surgery when other hemostatic measures fail. Because its action is prompt as well as predictable, it materially speeds up surgical procedures.

**Venoms.** Moccasin and other snake venoms were introduced fairly recently for treatment of hemorrhage. It is probable that their effect in hastening the coagulation of the blood is due to the activation of prothrombin; they are of distinct value in cases where no disturbance of the normal clotting mechanism exists. The activation of prothrombin leads to an abnormally rapid coagulation. There is considerable clinical evidence as to the value of these venoms in the treatment of nosebleed, excessive hemorrhage after tooth extraction, and in a blood disease known as purpura. Its effectiveness in hemophilia is uncertain.

**Vitamin K** is essential for the production of prothrombin. It is seldom lacking in the body except in newborn babies or when there is an obstruction of the biliary passages. Vitamin K administration is indicated only under these circumstances and for antidoting dicoumarin overdosage. A. EARL VIVINO

**HEMP,** an annual bushy plant belonging to the Nettle family, *Urticaceae*. These plants have racemes of green flowers, toothed leaves, and a rough, hollow stem. They are native to central and western Asia and are cultivated extensively in both temperate and tropical regions. Hemp, *Cannabis sativa*, thrives best in humid climates having rich, humus soils.



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Hemp may be harvested by uprooting or cutting

Retted Manila hemp straw is spread to dry

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**Uses.** Hemp is grown for its seeds and fibers and for the drugs obtained from its flowering tops and leaves. The seeds contain an oil used in soaps, paints, and as a substitute for linseed oil; the narcotic drug, CANNABIS, obtained from the leaves and dried tops, is used in relieving pain and in the treatment of nervous disorders. Hashish and marihuana, powerful narcotic drugs, are prepared from resinous substances also obtained from the leaves and flowers.

Hemp fibers develop in the pericycle of the stem. Although lacking the flexibility and elasticity of flax, the fibers are extremely valuable because of their great strength and durability. The plants are harvested by hand or machine, tied in bundles and dried. They are then retted in dew or water to separate the fibers from the bark. After separation the fibers are broken, scutched, and hackled. Hemp fibers are used in the manufacture of ropes, twine, carpets, sailcloth, yacht cordage, sacks, bags, and webbing. Fine grades, the long fibers, are used in making a cloth similar to coarse linen, while the short fibers are used in calking and cooperage materials and pump and engine packings. Waste and woody stem fibers are used in papermaking. See MANILA HEMP; SISAL. J. P. C.

**HEMPSTEAD**, village, SE New York, in Nassau County, on Long Island, and the Long Island Railroad, 23 miles E of New York City. Hempstead, first settled in 1644, is a residential suburb and a trade center for the surrounding communities. The St. George Protestant Episcopal Church here has musket holes made by British soldiers who were garrisoned in the village during the Revolutionary War. Hempstead is the seat of Hofstra College. Mitchel Field, U.S. Air Force base, is located near by, and two miles south of the city is Hempstead Lake State Park. Pop. (1950) 29,135.

**HEMS.** See HOMS.

**HENBANE**, a poisonous weed belonging to the Nightshade family, *Solanaceae*. *Hyoscyamus niger*, the black henbane, is an annual or biennial plant found on wastelands and on sandy ground. It has sessile yellow flowers and funnel-shaped plaited corollas. The sea green leaves are alternate, toothed, and hairy, and have a strong unpleasant odor. Henbanes are narcotic herbs, the leaves containing such poisonous alkaloids as ATROPINE and ACOPOLAMINE.

**HENCH, PHILIP SHOWALTER**, 1896–, American physician, was born in Pittsburgh, Pa. He took his undergraduate work at Lafayette College, received his doctor's degree from the University of Pittsburgh in 1920, and later (1928–29) studied in Germany. In 1921 he began his long association with the Mayo Clinic in Rochester, Minn. He was especially interested in arthritis, and working with Dr. Edward C. Kendall of Mayo, isolated the hormone which was later to be synthesized as *cortisone*. He had also introduced ACTH, a hormone produced by the pituitary gland, in the treatment of arthritis. In 1950, Hensch shared the Nobel prize for medicine with Dr. Kendall, and with TADEUS REICHSTEIN of Switzerland, for research on suprarenal cortex hormones.

**HENDAYE**, town, SW France, in the department of Basses Pyrénées, on the estuary of the Bidassoa River of the Spanish frontier; 14 miles SW of Biarritz, on the main road and railway to Spain. An international bridge crosses the river to Irun, junction of the French and Spanish railways. Hendaye is a popular resort, with beaches fronting the Bay of Biscay. The roadstead of the Bidassoa is an international port. Pop. about 6,000.

**HENDERSON, ALEXANDER**, 1583–1646, famous Scottish clergyman, was born in the parish of Creich, Fifeshire. He took a leading part in opposing the attempt to force a liturgy on the Scottish Church (1636), and from that time he was the foremost Presbyterian leader of his day. He was moderator of the General Assembly in 1638; was made minister of the High Kirk, Edinburgh, in 1639; and was one of the commissioners who arranged the pacification of

Berwick (1639). He accompanied the Scottish Covenanting army into England (1640), and became chaplain to Charles I in 1641. He drafted the Solemn League and Covenant, and took an active part in the work of the Westminster Assembly of Divines (1643).

**HENDERSON, ARTHUR**, 1863–1935, British public official, born in Glasgow. He worked as a molder in Newcastle and in Durham, became prominent in the trade union movement and was mayor of Darlington in 1903. In May, 1915, on the formation of the coalition government, he was appointed president of the Board of Education, becoming a member of the cabinet council. In August, 1916, he left the Board of Education to take up the duties of paymaster general and labor adviser to the government. On the reconstruction of the ministry in December, 1916, he was appointed a member of the Cabinet War Committee without portfolio. In the first MacDonald ministry he was secretary of state for home affairs (1924) and in the second was foreign secretary (1930–31). The 1933 Wateler peace prize was awarded to him by the Carnegie Foundation for International Peace, for his work as president of the World Disarmament Conference at Geneva in 1932–33. In 1934 he received the Nobel peace prize.

**HENDERSON, JAMES PINCKNEY**, 1808–58, American soldier and public official, was born in Lincoln County, N.C. He became a lawyer and served as brigadier general in the Texas revolution of 1836, was secretary of state of that republic in 1837–39, and in 1838 was envoy to France and England to secure recognition of the independence of Texas. In 1844 he was minister extraordinary to the United States, and in 1845 was elected first governor of the state of Texas. He became a U.S. senator in 1857.

**HENDERSON, Sir NEVILLE**, 1882–1942, British diplomat, was appointed ambassador to Germany in 1937, after a long and varied career in diplomacy. In the fall of 1939 he vainly tried to prevent Germany from attacking Poland and forcing Britain into a war. Upon his return to England at the outbreak of hostilities, he wrote his autobiographical *The Failure of a Mission* (1940), the first important source book of World War II.

**HENDERSON, RICHARD**, 1734–85, American pioneer, one of the founders of Kentucky, was born in Hanover County, Va. He moved to North Carolina in 1762, and though he had little general education and still less training in law, he became an associate justice of the North Carolina Superior Court (1769). He organized and was president of the famous "Transylvania Land Company," which, by the Treaty of Watauga with the Cherokee Indians, acquired (March, 1775) a large tract of land between the Cumberland and Ohio rivers, to which many settlers soon came and on Henderson's initiative, adopted a brief code of laws. This project was declared null and of no authority by the Virginia legislature, which also refused to recognize the validity of the Indian treaty. Henderson moved to Tennessee in 1779, practicing law at Nashville, and after 1780 he again lived in North Carolina. See DANIEL BOONE.

**HENDERSON, city**, NW Kentucky, county seat of Henderson County, on the Illinois Central and the Louisville and Nashville railroads, and U.S. highways 41 and 60; about 12 miles S of Evansville, Ind. Henderson, an industrial center in a fertile agricultural region near coal fields, is situated on high red bluffs facing the Ohio. It was founded in 1797 by the Transylvania Company under the leadership of Col. Richard Henderson. John James Audubon, the famous ornithologist, lived in Henderson from 1810 to 1819. Near the city is the 440-acre Audubon Memorial State Park with a museum which contains collections of Audubon's books, prints of birds, and stuffed birds. The principal manufactures of the city include wooden boxes, baskets, furniture, dresses, food products, carbon black, and cotton sheeting. Pop. (1950) 16,837.

**HENDERSON**, unincorporated town, SE Nevada, Clark County, on the Union Pacific Railroad and U.S. highways 93, 95, and 466; 14 miles SE of Las Vegas. It is the site of a basic magnesium plant established during World War II. Pop. (1950) 3,643.

**HENDERSON**, city, N North Carolina, county seat of Vance County, on the Seaboard and the Southern railroads, and U.S. highways 1 and 158; about 45 miles NE of Raleigh. Henderson is a cotton and bright leaf tobacco center. It was laid out in 1840 and named for Leonard Henderson, state supreme court chief justice. Pop. (1950) 10,996.

**HENDERSON**, city, E Texas, county seat of Rusk County, on the Missouri Pacific Railroad, and U.S. Highway 79; about 70 miles SW of Shreveport, La. It was founded in 1844 and named for J. P. Henderson, first governor of Texas. On the southern edge of Henderson is the site of Old Shawnee Town. Oil was discovered in the vicinity of Henderson in 1930, and its development is the dominant industry of the city. Pop. (1950) 6,833.

**HENDERSONVILLE**, city, W North Carolina, in Henderson County, on the Southern Railroad and U.S. highways 25, 64, and 176, about 20 miles SE of Asheville. It is a popular summer resort. Its factories produce printed cloth, paper boxes, yarn, hosiery, and pottery. Pop. (1950) 6,103.

**HENDON**, urban district, England, Middlesex, six miles NW of St. Paul's, London, including Golders Green and Hampstead Gardens, incorporated in 1932 as a residential suburb. It has mineral water distilleries, the Metropolitan Police College (established in 1934), and an important R.A.F. airfield. The airfield and a large water supply reservoir were attacked constantly by German air raiders through 1940-41. Pop. (1950 est.) 159,820.

**HENDRICK, BURTON JESSE**, 1871-1949, American author, born in Hew Haven, Conn., and was graduated from Yale University in 1895. He served on the staffs of several newspapers and magazines. His *The Life and Letters of Walter Hines Page* (1922) won the Pulitzer prize for biography, and *The Training of an American: The Earlier Life and Letters of Walter Hines Page* won a similar award in 1929. In 1931 he shared the Pulitzer prize for history with Adm. William S. Sims for their *Victory at Sea*. His other works include *Bulwark of the Republic: a Biography of the Constitution* (1937) and *Statesmen of the Lost Cause* (1939).

**HENDRICKS, THOMAS ANDREWS**, 1819-85, American political leader, vice-president of the United States (1885), was born near Zanesville, Ohio. He was elected governor of Indiana, serving from 1873 to 1877. In 1876 he was an unsuccessful candidate for vice-president on the ticket with Samuel J. Tilden, the election being contested, but being decided by the Electoral Commission in favor of his Republican opponent, William A. Wheeler. In 1884 he was elected vice-president on the ticket with Grover Cleveland, but died in office (Nov. 25, 1885) less than nine months after being inaugurated.

**HENDRIX COLLEGE**. See **COLLEGES**.

**HENEQUEN**, a native Mexican plant characterized by spiny leaves and strong-scented flowers. It is cultivated for its elastic, straw-colored fibers, which are used in the manufacture of twine and lariats. Henequen, *Agave fourcroydes*, belongs to the family *Amaryllidaceae*. See **AGAVE**.

**HENGIST**, d. 489 and **HORSA**, d. 455, legendary princes of the Jutes who are said to have landed in England at Ebbsfleet, on the Isle of Thanet (449), having been invited by King Vortigern of the Britons to help him in repelling the Picts and Scots. Later they turned against the Britons themselves. The whole story has no historical basis.

**HENGYANG**, city S China, in SE Hunan Province, 140 miles S of Changsha, the provincial capital, on the left bank of the Siang River, 40 miles SE of the Heng Shan (Nanjo), one of China's five classical mountains. The city is of great strategic importance

because of its position on the Hankow-Canton Railway, which branches off in Hengyang to Kweilin, the capital of Kwangsi. Besides the railway system, Hengyang is connected through rivers and roads with many towns and cities of Hunan and the neighboring provinces. The main products of the Hengyang district are cereals, rice, coal, paper, tobacco, indigo, silver, zinc, and tin. After the capture of Changsha in June, 1944, the Japanese made a special drive toward Hengyang for control of that railway section, forcing the American air force to abandon their near-by air base, and occupied the city after one month of heroic Chinese resistance, during which time Hengyang was partly destroyed. The population greatly decreased in that summer, since many people fled to Kweilin and other cities. Pop. (1947 est.) 200,000.

HILDE KIANG

**HENIE, SONJA**, 1913- , Norwegian figure skater, was born in Oslo. She was women's world champion figure skater (1927-36) and won Olympic championships in 1928, 1932, and 1936. Going to the United States in 1936, she became a star in motion pictures and ice revues. See **SKATING** for illustration.

**HENLE, FRIEDRICH GUSTAV JAKOB**, 1809-85, German anatomist and histologist. Henle was the first to identify the epithelium; this and his other observations in anatomy place him among the great anatomists of all time. From his study of the minute structure of tissues, the whole science of histology developed. No less important than these contributions was Henle's concept that contagious diseases are caused by minute living organisms. This theory was postulated in *Pathologische Untersuchungen* (1840).

**HENLEY, WILLIAM ERNEST**, 1849-1903, English critic and poet, was born in Gloucester. He was editor of the *Magazine of Art* (1882-86), the *National Observer* (1888-93), and the *New Review* (1893-98) and published a number of volumes of essays and poems, including *Book of Verses* (1888), *Views and Reviews* (1890), *The Song of the Sword* (1892), *Hawthorne and Lavender* (1899), and *In Hospital* (1903). With his friend Robert Louis Stevenson, he wrote the plays *Deacon Brodie*, *Beau Austin*, *Admiral Guinea*, and *Macaire*. Permanent lameness, which followed a severe illness, made Henley moody and cantankerous, and led him to assume the "masterful," challenging attitude toward life which is the burden of much of his poetry, notably the poem "Invictus," beginning "Out of the night that covers me."

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**HENLEY-ON-THAMES**, market town and municipal borough, S central England, Oxfordshire, on the Thames River at the foot of the Chiltern Hills; six miles NE of Reading and 35 miles W of London. It has a parish church in Decorated Perpendicular style. The town has been famous since the days of Henry VIII for its annual regatta, held in July. There is trade in corn, malt, flour, and beechwood. Pop. (1950 est.) 7,500.

**HENLOPEN, CAPE**, Delaware, the SW headland at the S entrance to Delaware Bay, opposite and 13 miles SW of Cape May.

**HENNA**, a substance used in the East for dyeing the nails, hair, and beard. It is obtained from the leaves of a tropical shrub or tree, *Lawsonia alba*. The leaves are dried, powdered, and made into a paste with hot water and catechu. Henna is used for coloring leather and various fabrics, and is an ingredient of various cosmetics and pharmaceuticals. An excellent perfume is prepared from the flowers of the same shrub.

**HENNEPIN, LOUIS**, c. 1640-c. 1706, Belgian Recollect missionary and explorer in America, was born in Ath. Impelled, it appears, more by love of adventure than by missionary zeal, he went to Canada in 1675. In 1678 he joined LA SALLE, then starting on his most famous expedition, and from Fort Crèvecoeur (near the present Peoria, Ill.) was dispatched (1680), with two companions, to explore the upper Mississippi





MINNESOTA HISTORICAL SOCIETY

Statue of Louis Hennepin in Minneapolis, Minn.

and the Illinois to its mouth. On April 11, 1680, he was captured by a band of Sioux Indians, probably near the mouth of the Wisconsin River, and was adopted into the tribe. During his captivity he visited the Falls of St. Anthony, probably being the first white man to accomplish this, and escaping, returned with DANIEL GREYSOLON DULHUT to Fort Frontenac (1681). Soon afterward he returned to France, and in 1683 published his famous book *Description de la Louisiane nouvellement découverte*, describing his travels and containing the first descriptions ever published of Niagara Falls and the Falls of St. Anthony. In 1697, La Salle then being dead, he issued a new edition, *Nouvelle découverte d'un très grand pays situé dans l'Amérique*, in which he claimed to have preceded La Salle in passing down the Mississippi to its mouth.

These two books of Hennepin became best sellers in their day. In the main, his first book was a useful narrative, although it revealed the author's vanity and his love for exaggeration. The second, however, is a tissue of falsehoods embellished with descriptions plagiarized from his fellow Recollect Zenobius Membre, who had accompanied La Salle on the voyage down the Mississippi in 1682. Francis Parkman calls this narrative "a rare monument of brazen mendacity," and he characterizes Hennepin as "the most impudent of liars." Hennepin's third book, *Le Nouveau Voyage* (1698) was even less reliable. For example, in the first book Hennepin had described Niagara Falls as 500 feet in height; in the second they were 600 feet high and in the third 700. But as Thwaites remarks, "For a barefooted mendicant friar, Hennepin appears to have been uncommonly acute in making his narrative attractive." See MINNESOTA for picture.

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**HENNER, JEAN JACQUES**, 1829–1905, French painter, was born in Bernwiller, Alsace. After studying art in Strasbourg, Basel, and Paris, he won the Prix de Rome in 1858 with his painting, "Adam and Eve Finding the Body of Abel." A specialist in nudes, Henner was much influenced by Correggio in such pictures as "The Chaste Susanna" and "Nudes."

## Henry

**HENRI, ROBERT**, 1865–1929, American painter and teacher, was born in Cincinnati, Ohio. He studied at the Pennsylvania Academy of Fine Arts and in Paris and attained wide popularity for his fresh and realistic character studies and portraits. He taught in a number of art schools with inspiring results, stressing visual honesty. His "The Art Spirit" was compiled from his essays and classroom comments. "La Neige" in the Luxembourg, "Young Woman in Black" (Chicago Art Institute), and "The Spanish Gypsy" (Metropolitan Museum, New York) are examples of his work. Henri was the leader of "The Eight," a group of artists who stressed contemporary subject-matter. See AMERICAN PAINTING.

**HENRIETTA MARIA**, 1609–69, the youngest daughter of Henry IV of France and Marie de' Medici, married CHARLES I of England in 1625. Between 1629 and 1639 (the period of government without Parliament) she opposed Laud's proclamation against Roman Catholic recusants, and raised money for the royal cause in the bishops' wars (1639). After the meeting of Parliament she encouraged the army plot, attempted to save Strafford, and urged Charles to arrest the five members. From 1644 to 1660 she lived in France. At the restoration she returned to England, but in 1665 again went to France.

**HENRY I**, known as **Henry the Fowler**, c. 876–936, German king, reigned from 919 to 936. He was Duke of Saxony when elected to succeed King Conrad I. After subduing various Slavic tribes and conquering their capital, Brennabor (now Brandenburg), he repelled a strong Hungarian invasion into central Germany (933) and made his power felt against the Danes. He built fortified settlements for the peasants fleeing from the Hungarians, and in so doing he became the founder of many German towns.

**HENRY II, SAINT**, 973–1024, German emperor, reigned from 1002 to 1024, great-grandson of King Henry I. He was Duke of Bavaria when he was chosen to succeed Otto III. In 1004 he became king of Italy, and in 1014 was crowned emperor at Rome. For 16 years (1002–18) he warred against the Duke of Poland, who had seized Bohemia and Silesia. Though Henry compelled him to yield Bohemia and Meissen, the duke maintained an independent attitude, and after Henry's death became king of Poland. Henry also had a long and severe struggle with Arduin, margrave of Ivrea in Italy, and found it a difficult task to curb the German nobles at home. He was buried at Bamberg in the beautiful Romanesque cathedral he had built. In 1146 he and his wife, Kunigunde, were canonized by the Church.

**HENRY III**, 1017–56, German emperor, called **The Black** because of his swarthy complexion, reigned from 1039 to 1056. The son of Emperor Conrad II, he succeeded his father. He forced the Duke of Bohemia to recognize his suzerainty and established his nominee, Peter, on the throne of Hungary (1042–47) but was unable to impose his power on Peter's successor. He subjected the Normans in southern Italy. Under the influence of his wife, Agnes of Poitou, he became an ardent supporter of the reform movement originating in the monastery of Cluny, France, and aiming at the spiritual renovation of the Church. With this in mind he deposed three rival popes at the Synod of Sutri (1046). It was ironical that Hildebrand (later Pope Gregory VII), who had accompanied the deposed pope Gregory VI into German exile, became the head of the reform party after Henry's death and deposed Henry's son, Henry IV, 30 years after Sutri. Henry greatly fostered learning and art. He was buried in the lofty Romanesque church begun by his father at Spire as a crypt cathedral for the German emperors and completed by himself.

**HENRY IV**, 1050–1106, German emperor, son of Henry III, ascended the throne under the regency of his mother, Agnes of Poitou, and ruled 1056–1106; but in 1062 Hanno, archbishop of Cologne, seized

the king and governed the empire in his name. Adalbert, archbishop of Bremen, however, soon rescued Henry from Hanno's hands, and declared him to be of age (1065). In 1070, however, he finally shook off the tutelage of the princes, and proceeded to curb the power of the great princes (e.g., Bavaria, Saxony, Swabia, and Carinthia), and in 1073-75 he brought the recalcitrant Saxons to their knees. But the severest struggle of his reign was against the energetic and ambitious Pope GREGORY VII (Hildebrand), who in 1076 excommunicated Henry; and it was only by personally humiliating himself, barefoot and in sackcloth, for three days, outside the castle of Canossa (January, 1077) in Italy, that the emperor was able to get the papal ban removed. Meanwhile the German princes elected a successor to Henry in Rudolf of Swabia; but Rudolf fell in battle (1080), and the emperor, in spite of a second ban of excommunication, not only set up a rival pope (Clement III), but marched into Italy, punished the Countess MATILDA of Tuscany, one of the principal supporters of Gregory VII, took Rome (1084), and had himself crowned emperor in that city by Clement III. In Germany the princes chose Hermann of Luxembourg as German king; but after his return home (1085), Henry, chiefly with the powerful assistance of Frederick of Satufen, duke of Swabia, gradually beat down all opponents. But from 1093 to the end of his reign he was engaged in renewed strife, first against the successors of Gregory VII, and secondly against the hostile princes in Germany, who won over to their side Henry's own sons, Conrad and Henry, the latter of whom actually took his father prisoner and forced him to abdicate at Ingelheim (1105) but Henry escaped.

**HENRY V**, 1081-1125, German emperor, son of Henry IV. Although he had gained the crown in 1106 with the help of the papal party, Henry nevertheless continued the struggle, as to the right to grant investiture, with Pope Paschal II, whom he took prisoner in Rome (1111). In the following year the Synod of Vienne excommunicated the emperor, and the ban was not removed until the investiture dispute was definitely settled by the Concordat of Worms (1122), the pope securing the right to nominate the great ecclesiastics, and the emperor the right to grant them investiture of their temporal possessions.

**HENRY VI**, 1165-97, German emperor, son of Frederick I, Barbarossa, wed Constance, heiress to the kingdom of Sicily. He ruled from 1190 to 1197. One of the main objects of his policy was to make himself master of that island, but he encountered fierce opposition (1191-94). Another was to abolish the elective character of the imperial sovereignty, and have it declared hereditary in his own family—a project which failed owing to the antagonism of the princes (1196). In 1193 RICHARD I of England was delivered into his power by the Duke of Austria, and was only liberated for a large ransom in 1194. Henry died in Sicily.

**HENRY VII**, 1269-1313, German emperor, son of the Count of Luxembourg. On the death of Albert I the electors chose (1308) Henry, count of Luxembourg, as German king, and in 1309 he became German emperor. He died in Italy, where he had gone to establish the imperial authority, disputed by the pope and by the Anjou dynasty in Naples. He befriended DANTE, and the latter immortalized him as the ideal emperor in his book *De Monarchia*.

**HENRY I**, 1068-1135, king of England, the younger son of WILLIAM I and Matilda, was born at Selby in Yorkshire. He succeeded his brother, William Rufus, in 1100, and strengthened his position by marrying Eadgyth (known as Matilda), daughter of Malcolm, king of Scotland, and of Margaret, granddaughter of Edmund Ironside. His charter of liberties, his recall of Anselm, and his arrest of Flambard testified to his prudence and sagacity. Robert of Belesme persuaded Robert, Henry's elder brother, to assert his

claims to the English throne. After suffering an overwhelming defeat at Tinchebrai (1106), Robert was imprisoned in Cardiff Castle, and Normandy was united to England. William, Robert's son, secured the assistance of Louis VI, king of France, and the counts of Flanders and Anjou. To defend himself against this combination, Henry married his daughter, Matilda, to the Emperor Henry V, gained over the Count of Anjou, and in 1119 defeated the French king at Brémule (Brennville). William, Henry's only son, was drowned in 1120 in the *White Ship*.

During these years Henry I had been busy with religious disputes, especially the investiture question. (See ANSELM.) The Curia Regis became the center of an administrative system by which the counties and the sheriffs were connected with the central government. The financial side of the Curia Regis, known as the exchequer, was developed. A monastic revival took place during the reign, and the Austin canons and the Cistercians settled in England. Henry died suddenly at Angers in Normandy, and was buried at Reading.

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**HENRY II**, 1133-89, king of England, was the eldest child of Matilda, daughter of Henry I, and of Geoffrey PLANTAGENET, and succeeded Stephen as king in 1154. From his father and mother he inherited Anjou, Touraine, Normandy, and Maine; while through his wife, ELEANOR of AQUITAINE, the divorced queen of Louis VII, he secured Poitou, Périgord, Limousin, and Gascony, together with claims on the county of Toulouse, and a nominal suzerainty over the land on the west bank of the Rhône. A vigorous, hard-working man, skilled in diplomacy, and a lover of the law, Henry revoked his predecessor's grants of crown lands, destroyed the "adulterine" castles built by the barons, expelled all mercenaries, and abolished the "fiscal" earldoms. To free himself from dependence on the barons, he took from them scutage in lieu of personal service for 40 days (1159). Wales and Scotland were forced to recognize his authority. A quarrel with the Archbishop of Canterbury, THOMAS A BECKET, led, however, to the Constitutions of Clarendon (1164), the effect



Henry II

of which was in great part destroyed by the murder of Becket (1170). To avoid the papal legates, Henry entered on conquest of Ireland (1171). See IRELAND, *History*.

In 1166 the Assize of Clarendon compelled all men to come, when required, to the county courts, and brought the barons within reach of the law. In 1170 the Inquest of Sheriffs was followed by the dismissal of most of the sheriffs. The barons rose with the king's own sons, William the Lion of Scotland, Philip of Flanders, and Matthew of Boulogne. But the rebellion was speedily crushed by Henry II, who, having captured William the Lion, forced him to sign the Treaty of Falaise (1174). In 1176 the Assize of Northampton, in 1181 the Assize of Arms, in 1184 the Assize of Woodstock, were issued. By these laws the baronial power was still further checked, the people were armed, and the king's supremacy over the forests firmly established. In 1188, to raise money for a crusade, the Saladin tithe was collected and personal property was taxed. Henry's later years were full of trouble. Philip Augustus, the French king, intrigued with Henry's sons against their father, who at length, worn out and disillusioned, died at Chinon. Henry's reign marks the development of the jury system. He



was the first of the Angevin, or Plantagenet, line of kings.

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**HENRY III**, 1207–72, king of England, the eldest son of John and Isabella, was born in Winchester, and was crowned king of England in Gloucester on Oct. 23, 1216. As Henry was only a child, England was governed till 1232 by ministers. William Marshal (1216–19) and Hubert de Burgh overthrew the French, who were endeavoring to convert England into a French province. Magna Charta was reissued, and a forest charter was put forth. Pious, and a lover of art and literature, Henry III so far represented the age in which he lived; but he was faithless, wanting in energy, and irresolute. Consequently his reign was full of troubles. In 1232 Hubert de Burgh was dismissed, and Peter des Roches, bishop of Winchester, who succeeded Hubert, was so unpopular that in 1234 he was removed from power.

In 1236 Henry married Eleanor of Provence, and a host of Provencals invaded England. From this time the opposition of the clergy and barons became more and more pronounced. Papal exactions led Grosseteste, bishop of Lincoln, to take up an attitude of opposition; while Henry's failure in France (1242–43), and his refusal to fill up the great offices of state, increased the irritation of the barons. At the same time, the rapacity of the sheriffs threw the knights of the shire on the side of the opposition. The crisis came to a head through Henry's acceptance of the crown of Sicily for his second son, Edmund. In 1258 a Parliament, known as the "Mad Parliament," was called to Oxford. Leaders were found in Richard of Clare, earl of Gloucester, and in SIMON DE MONTFORT, who had married the king's sister. The Provisions of Oxford were drawn up, a period of reform was inaugurated, and from 1258–64 a struggle took place between the king and the barons.

A treaty at Paris in 1259 removed all outstanding difficulties over foreign questions, and in 1264 Henry and the barons referred their disputes to Louis IX of France. By the Mise of Amiens (January, 1264) Louis annulled the Provisions of Oxford. Civil war ensued; Henry was defeated and captured at the Battle of LEWES (May, 1264), and promised, in the Mise of Lewes, to accept the Provisions of Oxford. To strengthen his position, Simon called a Parliament in 1264, at which four knights from each shire appeared; in 1265 burgesses from certain towns were summoned, together with knights of the shire. But on Aug. 4, 1265, Simon was defeated and killed at Evesham by Prince Edward. The Dictum de Kenilworth (1266) and the Statute of Marlborough (1267) brought the struggle to a close. In this reign the friars settled in England, and taught at Oxford. During the barons' war Llewelyn of Wales had supported the barons, and it was not till 1267, by the treaty of Shrewsbury, that Wales was pacified. On Nov. 16, 1272, Henry III died in Westminster, and was buried in the Abbey.

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**HENRY IV**, 1367–1413, king of England, son of John of Gaunt, was born in Bolingbroke in Lincolnshire, and succeeded RICHARD II in 1399. Besides aiding the Teutonic Knights against the heathen Prussians, he fought in the East (1392–96) in crusading and other enterprises. For the help he gave Richard II in putting down the Duke of Gloucester's rebellion he was made earl of Hereford; but in the following year

(1398), when he quarreled with Norfolk, he was banished from the kingdom (cf. Shakespeare's *Richard II*). The king having confiscated his estates on the death of John of Gaunt, Henry landed in England to recover them by force. Many English leaders rallied to his support, and as a result Richard was compelled to abdicate, and Henry became king, the first of the Lancastrian line. See LANCASTER, HOUSE OF.

Soon after Henry's accession a rebellion broke out in Wales, headed by Owen Glendower, and the Scots crossed the Border. The latter were overthrown at Homildon Hill (1402); but the Percies quarreled with Henry over the ransom of the Scottish captives, and joined Glendower. At the battle of Shrewsbury (1403), Henry (Hotspur) Percy was slain, and the Welsh were defeated. In 1405 Scrope, archbishop of York, rebelled, but was easily overthrown; and in 1408, at Bramham Moor, the old Earl of Northumberland was killed, and the Percies were subdued. Meanwhile Henry had given Parliament considerable powers, and in 1407 the Commons gained the right of initiating money grants. In 1406 Prince James, the heir to the Scottish throne, was captured and detained in England for many years. The last years of Henry's reign were marked by struggles for control of the king's council, between the King and his friends, and a party headed by the Prince of Wales.

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**HENRY V**, 1387–1422, king of England, son of Henry IV, whom he succeeded in 1413, was born at Monmouth. The Lollard Movement caused the government anxiety, and Henry continued his father's repressive policy, Sir John Oldcastle (Lord Cobham), the Lollard leader, being executed as a heretic in 1417. Meanwhile the ravages of privateers from Normandy made an invasion of France popular. In September, 1415, an English force landed in France, and on October 25 Henry won the battle of AGINCOURT. In 1417 a second invasion took place, and Rouen was captured. The murder of the Duke of Burgundy by the Armagnacs threw his son into close alliance with England (1419), and in 1420 the Treaty of Troyes was signed. Henry became regent of France, with the right of succession, and married the French princess Catherine. For the rest of his life Henry was occupied in anglicizing Normandy, and in checking risings in France against the English predominance. In 1421 the dauphin defeated and killed the duke of Clarence (Henry's brother) at Beaugé, but in 1422 Henry captured Meaux. He died in Vincennes, and was buried in Westminster Abbey. See LOLLARDS.

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**HENRY VI**, 1421–71, king of England, the son of Henry V, was born at Windsor, and became king in 1422. During his long minority (till 1442) the Privy Council, under the control of Parliament, governed the country. The Duke of Bedford, Henry V's eldest brother, was regent in France; and Gloucester, his youngest brother, was made protector of the realm; while Henry Beaufort wielded great influence. Bedford made a league with the dukes of Burgundy and Brittany, and won the battles of Crévy (1423) and Verneuil (1424). At the same time he sent James of Scotland back to his own land. Gloucester, however, endangered the Burgundian alliance by marrying Jacqueline of Hainault, cousin of the Duke of Burgundy, and had roused discontent in England by quarreling with Henry Beaufort. Meanwhile Orleans (1428–29) was saved by JOAN OF ARC. Though Henry VI was crowned in Paris, the conclusion of peace

between Charles VII of France and Burgundy, together with the death of Bedford (1435), ruined the success of the English in France. Richard, duke of York, and John, Lord Talbot, made courageous attempts to hold their own in Normandy and Guienne; but the influence of Margaret of Anjou, who married Henry VI in 1445, the death of Beaufort in 1447, the foolish policy of Suffolk and Somerset, and the rising national feeling among the French, led in 1453 to (with the exception of Calais) the total loss of the English possessions in France.

**Wars of the Roses.** In 1455 the Wars of the Roses opened with the first Battle of St. Albans; and during the rest of Henry VI's reign the Yorkists, or supporters of Richard, duke of York, fought against the Lancastrians, or supporters of the ruling dynasty. Jack CADE's rising in 1450 had testified to the incompetence and unpopularity of the government; and throughout the Wars of the Roses the commercial classes sympathized with the Yorkist cause. The actual fighting was done by the nobles. After the Yorkist victory at Bloreheath (1459), followed by the Yorkist rout at Ludford-on-the-Teme, the Parliament at Coventry attainted the Yorkist leaders. In 1460 the Yorkist Earl of Warwick won the Battle of Northampton, and captured Henry VI. In October, 1460, York was declared heir to the throne; but on Dec. 31, 1460, he was defeated and slain at Wakefield, while Warwick was beaten at the second Battle of St. Albans (Feb. 17, 1461). London was saved from capture by the Lancastrians through the energy of Edward, York's eldest son, and of Warwick. Edward having won Mortimer's Cross, entered London (February 26), and was proclaimed king. In 1471 Henry VI was murdered in the Tower of London. See EDWARD IV; ROSES, WARS OF THE. S. W. X.

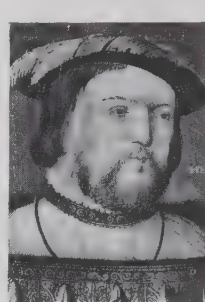
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**HENRY VII, 1457–1509**, king of England, the son of Edmund Tudor and Margaret Beaufort, heiress of John of Gaunt, was born at Pembroke Castle. Henry succeeded to the crown after defeating RICHARD III at the Battle of Bosworth in 1485. In the following year he strengthened his position by marrying Elizabeth, daughter of Edward IV (1486). He was himself descended on his mother's side from the Beauforts, the illegitimate descendants of John of Gaunt. To restore order, he enforced statutes against livery and maintenance, and set up a new court in 1487, known as the Court of Star Chamber, to keep down the nobles. In 1486 Lovell's plot was discovered, and in 1487 the rebellion of Lambert Simnel was suppressed by Henry's victory at Stoke, near Newark. On the Continent he endeavored to check the attempts of Charles VIII of France to conquer Brittany, and though he failed, he concluded an advantageous treaty at Etaples (1491). Ferdinand of Spain and Maximilian, the emperor, endeavored to secure Henry's adhesion to a league against France, and Ferdinand used his influence to secure the expulsion of Perkin Warbeck, a Yorkist pretender, from Flanders. Though Warbeck was well received in Scotland, his attempt to stir up the west of England led to his capture in 1497, and his death in 1499. Henry was then secure on his throne. In 1496 he made an important commercial treaty with Flanders, overthrew some Cornish insurgents at Blackheath in 1497, and made a treaty with Scotland the same year. By Poyning's Law (1494) he had restored order to Ireland, and in 1496 he allied with Spain, without endangering his friendship with France. During his reign commerce and geographical enterprise were encouraged. His ministers and agents, such as Archbishop Morton, Empson, and Dudley, played a notable part in raising money from the nobles, and the

Star Chamber proved a most valuable instrument. Henry VII died at Richmond. See TUDOR.

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**HENRY VIII, 1491–1547**, king of England, the second son of Henry VII, was born at Greenwich. In 1509, the year of his accession, he married CATHERINE of Aragon, the widow of his brother Arthur. During those years (1509–29) foreign affairs engrossed most of the attention of the government. Henry joined the Holy League, and in 1513 won the Battle of Guinegate and the Battle of Flodden. In 1514, at Wolsey's suggestion, he made peace with France, and his sister married Louis XII. In 1518 WOLSEY negotiated the



Henry VIII

Treaty of London between the Emperor Charles V and Francis I. Then the effects of the meeting between Henry VIII and Francis I on the "FIELD OF THE CLOTH OF GOLD" (1520) were nullified by Henry's meetings with Charles in England and at Gravelines. On the outbreak of war between Charles and Francis in 1521 Henry sided with Charles, and an English force under Surrey invaded France. It effected little, and after the capture of Francis at Pavia (1525) Henry and Charles became alienated, and in 1527 a French alliance was brought about by Wolsey's efforts.

**English Reformation.** Wolsey and the pope were regarded by the king as responsible for his failure to obtain a divorce against Catherine, and Wolsey was exiled to his diocese of York. In 1529 the famous Reformation Parliament met, and sat for seven years. Henry was now bent on securing the divorce at all costs. At this time THOMAS CROMWELL became Henry's principal minister, while CRANMER was made archbishop of Canterbury. In 1533 Cranmer declared Henry's marriage with Catherine of Aragon invalid, and the king at once married ANNE BOLEYN. Parliament then passed a number of enactments completely abrogating the papal authority in England. In 1535 it passed the Act of Supremacy, making Henry supreme head of the Church of England. Henry was now absolute, and till the end of his life he pursued a course unrestrained by any constitutional checks. In 1536 Anne Boleyn was executed on the ground of conjugal infidelity. Henry then married JANE SEYMOUR, and a son, afterward Edward VI, was born in 1537.

Meanwhile the Reformation movement advanced. While an English translation of the Bible was set up in all churches, the Ten Articles were, in 1536, published with a view of quieting the consciences of Englishmen. In 1536 the lesser monasteries were dissolved, with the full assent of king and Parliament. This act roused great discontent, and outbreaks took place in various parts of England, the Pilgrimage of Grace being the most serious. Having suppressed this rising, Henry set up the Council of the North, and began to dissolve the greater monasteries. Their wealth went, for the most part, into the pockets of the king and his friends.

Henry now agreed with Cromwell that an alliance with the North German Protestant princes was desirable, and married in 1540 ANNE OF CLEVES. Finding that this marriage had been rendered unnecessary by the outbreak of war between the emperor and Francis I, Henry now turned against Cromwell. He divorced Anne of Cleves, and in July, 1540, Cromwell, whose



influence had long been declining, was executed. The party of Roman Catholic reaction, headed by the Duke of Norfolk, thus triumphed, and Henry married Catherine Howard, niece of the duke. After the execution of CATHERINE HOWARD for conjugal infidelity, Henry married CATHERINE PARR, who was a supporter of Protestantism. In 1536 Wales was incorporated and given representatives in the English Parliament. See MARY I; ELIZABETH; EDWARD VI; ENGLAND, CHURCH OF. M. R.

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**HENRY I**, c. 1008–60, king of France, was the third son of King Robert I, and a descendant of Hugh Capet; he ascended the throne in 1031. He granted Burgundy to his younger brother; he failed to subdue the Count of Blois; he quarreled with Robert, the powerful Norman duke, and when he invaded Normandy, was defeated at Mortemer (1054) and Varaville (1058).

**HENRY II**, 1519–59, king of France, born in St. Germain-en-Laye, succeeded his father, FRANCIS I, in 1547. His wife was CATHERINE DE' MEDICI. His principal advisers were the Guises, and he greatly oppressed his Protestant subjects. His first war was with England, to help his Scottish allies, in which he recovered (1550) Boulogne from the English. He was equally successful against the Emperor Charles V, and seized Metz, Toul, and Verdun; and though Montmorency was badly beaten at St. Quentin (1557) CALAIS was recovered (1558). In July, 1559, Henry II died in Paris, from a wound received at a tournament at Château Cambresis after the signing of the treaty of that name.

**HENRY III**, 1551–89, king of France, the third son of Henry II and Catherine de' Medici, born in Fontainebleau, succeeded to the French throne in 1575, on the death of his brother, CHARLES IX. In 1573 he had been elected king of Poland. Civil war between the HUGUENOTS and Catholics occupied most of his reign. The Roman Catholic party of the Guises tyrannized over the king; Paris grew more and more independent. Henry at first adopted the policy of the (Roman Catholic) Holy League, formed in 1576; but its contempt of the royal power led him to have Guise assassinated (Dec. 23, 1588). Paris then rose against Henry, who united with his Protestant rival, Henry of Navarre. The capital was besieged, but was saved by Henry's assassination by Jacques Clément. See GUISE, HENRI.

**HENRY IV**, 1553–1610, king of France and Navarre, third son of Antoine de Bourbon, duke of Vendôme, and Jeanne d' Albret of Navarre and Béarn, was born in the castle of Pau, Béarn. He became king of Navarre in 1562. A nephew of Condé, he fought on the Protestant side at Jarnac, and after the Peace of St. Germain (1570) married Marguerite of Valois, sister of Charles IX of France. One result of the massacre of St. BARTHOLOMEW was that Henry was forced to accept Romanism, and was detained at the French court. But in 1576 he escaped, again adopted Protestantism, and resumed his command of the Huguenot army. On the death of Henry III Henry of Navarre became (1589) the lawful king of France. Nevertheless, from 1589 to 1595 Henry was compelled to fight the League, which was aided by Philip II of Spain. Mayenne, the League leader, was defeated at Arques (September, 1589), and at Ivry (March, 1590). Henry, by once more changing his faith, was, on March 21, 1594, able to enter Paris.

He then waged successful war against Spain, and suppressed the League. In 1598 Henry granted to the Huguenots the Edict of NANTES. The wars had left France in an exhausted condition, and Henry's great minister, SULLY, did much to restore its prosperity. He imposed new taxes, he enforced economy, he encouraged agriculture, while Henry introduced the silk industry into France. In 1600 he defeated the Duke of Savoy. Till the end of his life Henry did all he could to check the growth of the power of the Hapsburgs. On April 14, 1610, Henry was assassinated in Paris by Ravaillac.

**HENRY V**, king of France. See CHAMBORD, COUNT DE.

**HENRY II**, better known as **Henry of Trastamare**, 1333–79, Spanish King of Castile, natural son of Alfonso IX, was defeated by the Black Prince at Najera in 1367, when trying to recover the throne from Peter the Cruel; but he won it by the Battle of Montiel (1369), after which Peter was killed.

**HENRY III**, 1379–1406, Spanish king of Castile, grandson of Henry II, reigned from 1390. He lessened the power of the nobles, and maintained order in his kingdom. He married Catherine of Lancaster.

**HENRY**, 1726–1802, prince of Prussia, was born in Berlin, the youngest brother of Frederick the Great, who described him as the only general who made no mistakes during the SEVEN YEARS' WAR. He distinguished himself in the battle of Rossbach (1757) and won the victory of Freiberg (1762), which terminated the war. See FREDERICK II.

**HENRY, ALEXANDER**, 1739–1824, American fur trader, born in New Brunswick, N.J. He accompanied Amherst's expedition against the French in Canada in 1760, was one of the first to receive from the English authorities, after the conquest of Canada, permission to engage in the fur trade, immediately proceeded to Michilimackinac (Mackinac, Mich.), was there captured (1763) by the Indians during the conspiracy of Pontiac, escaped after a year, and was subsequently engaged in the fur trade in the Northwest, being the first English trader beyond the Ottawa. In 1796 he abandoned the fur trade and was thereafter a leading merchant in Montreal. He wrote *Travels and Adventures in Canada and the Indian Territories between the years 1760 and 1776* (1809; new ed. 1901), considered to be the best account of the beginnings of the English fur trade in the Northwest. His nephew, also named Alexander Henry, with whom he is sometimes confused, was also a fur trader, and in 1897 his "Manuscript Journals of a Fur Trader in the North-west Company" was published in New York under the title *New Light on the Early History of the Greater North-west* (3 vols.).

**HENRY, ANDREW**, c. 1775–1833, American miner, fur trader, and explorer, was a Pennsylvanian. He became an early Missouri lead producer. In 1809 he joined MANUEL LISA in a Missouri River trapping expedition and thereafter explored much unknown territory around the Missouri River headwaters and the region beyond the Rocky Mountains. He became famous for his wilderness adventures.

**HENRY, JOSEPH**, 1797–1878, American physicist, was born in Albany, N.Y., and studied at the Albany Academy, where in 1826 he became professor of mathematics and natural philosophy. As a result of his experiments in improving the electromagnet designed by William Sturgeon, he built the first electromagnet telegraph, about a mile long, in 1830, and designed the first electromagnetic motor in 1831. After he went to the College of New Jersey (now Princeton University) as professor of natural philosophy in 1832, he worked out the principle which made possible the telegraph relay instrument. He later had a controversy with SAMUEL F. B. MORSE about which of them was the inventor of the electric telegraph (see TELEGRAPHY). Henry conducted other research which pertained to the velocity of swiftly

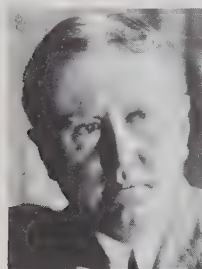
FREDERIC E. VOELKER

moving projectiles, the heat radiated from sunspots, and the degree of cohesion of liquids and solids.

In 1846 Henry was appointed first secretary of the Smithsonian Institution and held this post until his death. Made a member of the Lighthouse Board on its establishment in 1852, he served as its chairman after 1871 and made improvements in lighthouse beacons and fog signals. He was president of the National Academy of Sciences (1868-78) and wrote more than 150 papers on scientific subjects. His name has been applied by electrical engineers to the unit of inductance. See ELECTROMAGNET.

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**HENRY, O.**, pseudonym of William Sydney Porter, 1862-1910, American short story writer; born in Greensboro, N.C. He had little schooling but managed to acquire a fair education, including a knowledge of French, German, and Spanish. He worked as drug clerk, bookkeeper, draftsman, sheepherder, newspaper writer, bank clerk, and pharmacist. Convicted at Austin, Texas, on a charge of embezzlement, he served over three years in the Federal penitentiary at Columbus, Ohio, where he wrote several short stories. After his release in 1901 his literary productivity was enormous. His first book, *Cabbages and Kings* (1904), was a novel, but he is best known for his many volumes of short stories, especially *The Four Million* (1906) and *Roads of Destiny* (1909). He was a superb storyteller, but he wrote hastily and depended for effect upon surprising twists of plot and a breezy, colloquial style rather than sound characterization and the honest transcription



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O. Henry

of human experience. He was largely responsible for popularizing the "formula" short story: slick, readable, and superficial.

N. BRYLLION FAGIN

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**HENRY, PATRICK**, 1736-99, American orator and statesman, born in Studley, Hanover County, Virginia. His father was a Scotsman, a cousin of the historian Robertson, and his mother was a member of an old Virginia family, the Winstons, of Welsh descent. At school Patrick was an indolent and not an apt scholar. Later he thoroughly demonstrated his incapacity for business, and finally, after a brief course of study, was admitted to the bar (1760).



CHICAGO HIST. SOC.

Patrick Henry

As a lawyer he was almost immediately successful; he had more than 1,000 cases during the first three years of practice, and in 1763 he acquired sudden fame as an orator and greatly increased his practice by a radical speech in a celebrated case known as the "Parson's Cause." In this speech he denied the right of the king to abrogate acts of the colonial legislature. Henry was a member of the Virginia House of Burgesses (1765-74), attracting attention immediately by preparing and presenting the resolutions directed against the Stamp Act, and asserting the virtual independence of the colonial legislatures, so far at least as the British Parliament was concerned.

Throughout the period immediately preceding the Revolutionary War, Henry was an ardent leader of the opposition in Virginia to the aggressions of the home government; he was an influential member of

the Continental Congress (1774-76); and in 1775, before Virginia's second Revolutionary Congress, he urged the immediate arming for war of the Virginia militia, in a ringing speech, often quoted and declaimed, and closing with the words, "Is life so dear or peace so sweet as to be purchased at the price of chains and slavery? Forbid it, Almighty God! I know not what course others may take, but as for me, give me liberty or give me death!" He commanded the militia, but with no special brilliancy, for a time. He helped to frame a state constitution, was governor of Virginia in 1776-79, sat in the legislature in 1780-84, was again governor in 1784-86, and was once more in the Virginia legislature in 1786-90.

Henry declined to serve as a member of the Constitutional Convention of 1787, and in the Virginia convention called to consider the ratification of the Federal Constitution, led, with all his ability and fiery eloquence, but in vain, the opposition to that instrument. Thereafter he declined various high offices to which he was appointed; but in 1799 ran for the state legislature in order to combat the spirit disclosed in the "Virginia Resolutions," and was elected, but died, in Charlotte County, Va., before he could take his seat. Henry was, Webster alone excepted, probably the greatest of American orators. See UNITED STATES HISTORY; VIRGINIA for illustrations.

BIBLIOG.—G. Morgan, *The True Patrick Henry* (1907); J. M. H. Carson, *Son of Thunder, Patrick Henry* (1945).

**HENRY, WILBUR FRANK**, known as **Fats**, 1897-1952, American football player, was born in Mansfield, Ohio. A graduate of Washington and Jefferson College, where he played four years of football, Henry was named All American tackle in 1919 and has been a unanimous choice on all time All American teams. After playing professional football (1920-29) with Canton, Pottsville, and the New York Giants, he returned to Washington and Jefferson as assistant coach; in 1933 he became director of athletics.

**HENRY, WILLIAM**, 1774-1836, English chemist and physician, was born in Manchester; discovered the law of solubility of gases, known as "Henry's law"; wrote *Elements of Experimental Chemistry*, remarkable for accuracy in facts and literary elegance.

**HENRY**, the practical electric unit of self-induction. It represents the induction in a circuit when the inducing current changes at the rate of one ampere per second, and the emf (electromotive force) induced in one volt. See ELECTRODYNAMICS, *Mutual Induction*.

**HENRY, CAPE**, promontory, E Virginia, on the Atlantic Ocean, headland at the S entrance of Chesapeake Bay, 12 miles S and opposite Cape Charles and 16 miles NNE of Norfolk.

**HENRY, FORT**. See FORT DONELSON.

**HENRY OF HUNTINGDON**, 1084?-1155, English historian, born in East Anglia; became archdeacon of Huntingdon. He commenced the *Historia Anglorum*, a chronicle that is an important historical source.

**HENRY THE LION**, 1129-95, duke of Saxony and Bavaria, was the son of Duke Henry the Proud, and a cousin of the Emperor Frederick Barbarossa. He married Matilda, daughter of Henry II of England. Henry founded Munich, and encouraged the development of Hamburg, Lübeck, and other towns. Because of his refusal to assist in the Italian campaign of 1176, he was put under the ban of the Empire (1180), and his lands were declared forfeit. The next year he submitted and was allowed to keep his allodial estates in Lüneburg and Braunschweig. He then spent three years of exile in England. Upon his return to Germany he rebelled against Emperor Henry VI and destroyed the town of Bardowiek, but he became reconciled with Henry VI shortly before his death.

The lasting importance of Henry the Lion lies in the fact that he was one of the greatest German colonizers in the Slavic lands of eastern Germany. He died at Braunschweig and was buried in the



cathedral which he had built there and which survived the destruction of the city in World War II. His direct descendants were kings of England (House of HANOVER, 1714-1901). A younger branch of that house reigned in the Duchy of Braunschweig until 1918.

**HENRY THE MINSTREL**, or **Blind Harry**, fl. 1470-92, Scottish poet, supposedly a native of Lothian and blind from birth, appeared at the court of James IV in 1490, singing an epic ballad of nearly 12,000 lines, celebrating the deeds of "that Noble Champion of Scotland, Sir William Wallace, Knight." Blind Harry professed to have adapted the poem from a life of Wallace written by John Blair. Before the end of the 18th century many editions had been published, the most popular being that of William Hamilton.

**HENRY THE NAVIGATOR**, 1394-1460, Portuguese prince, son of John I, king of Portugal, and of Philippa, sister of Henry IV of England. After showing conspicuous courage at the siege of Ceuta in 1415, he devoted himself to the development of navigation and the fostering of maritime expeditions. His first voyage, in 1418, was unsuccessful, though three of his vessels later reached MADEIRA. In 1440 Cape Blanco was reached, in 1446 Cape Verde, and in 1448 the AZORES. He built an observatory and a school of discovery at Sagres, near Cape St. Vincent. See POLAND, *History*.

BIBLIOG.—E. Sanceau, *Henry the Navigator: the Story of a Great Prince and His Times* (1947).

**HENRYETTA**, city, E central Oklahoma, Okmulgee County; on the Frisco and the Kansas, Oklahoma, and Gulf railroads, and U.S. highways 75 and 266, about 15 miles S of Okmulgee. The city is a railroad and trading center for a region of farms, coal mines, and oil and gas wells. Henryetta was founded in 1901 when the Frisco railroad was built to this point. South of the city is the 640-acre Jack Nichols Recreation Park which has a 50-acre area set aside as the national campground for the Creek Indians. Zinc smelting, cotton ginning, and the manufacture of glass are the city's chief industries. Pop. (1950) 7,987.

**HENRY'S LAW** states that at any given temperature the solubility of a gas is proportional to the pressure of that gas. Thus, twice as much gas will dissolve in a liquid when the pressure is doubled. The law, formulated by WILLIAM HENRY, has practical applications in chemical manufacturing and in the manufacture of CARBONATED BEVERAGES.

**HENRYSON, ROBERT**, c. 1430-c. 1506, Scottish poet, was apparently a native of Fife. His most ambitious work was *The Morall Fabillis of Esope the Phrygian* (1570), paraphrased from Aesop. *The Testament of Cresseid* (1593) is a sequel to Chaucer's tale of Troilus and Cressida. *Orpheus and Eurydice* (1508), a long allegorical poem, is adapted from Boethius.

**HENSON, JOSIAH**, 1789-1883, American Negro slave and clergyman, was born in Port Tobacco, Md. He suffered very harsh treatment at the hands of his master, and yet in the course of time he became the foreman of the plantation and a preacher to the slaves around him. In 1830 he escaped and made his way to Canada with his wife and children. He became the leader of the community of escaped slaves at Dresden, Ontario, and learned to read and write. He told the story of his life to HARRIET BEECHER STOWE, who used it as the basis of her famous book, *Uncle Tom's Cabin*. His autobiography was published in 1849 and an enlarged edition, containing an introduction by Harriet Beecher Stowe, appeared as *Truth Stranger Than Fiction* (1858).

**HENTY, GEORGE ALFRED**, 1832-1902, English novelist and journalist, was born in Trumpington, near Cambridge. As a correspondent for the *London Standard*, he reported the Italo-Austrian War, the Franco-Prussian and Turko-Servian wars, and various insurrections and expeditions. His books for boys, of which he wrote about 80, include many historical

novels, which are well documented but are generally marked by a strong British bias. Some of his most popular stories were *Out on the Pampas* (1868); *The Young Franc-Tireurs* (1872); *Under Drake's Flag* (1883); *With Clive in India* (1884); *The Cat of Bubastes* (1889); *By Right of Conquest, or with Cortez in Mexico* (1891).

**HEPARIN** prevents or delays the clotting of blood and is employed in medicine and surgery as an aid in blood transfusions and for the prevention and treatment of THROMBOSIS AND EMBOLISM. The richest source of heparin is the liver, although it occurs in various other organs (e.g., in the lungs), and in very small amounts also in the blood. It is improbable that it is a major factor in maintaining the liquid state of the circulating blood. In anaphylactic SHOCK, however, heparin is liberated in large amounts and renders the blood of the victim incoagulable.

Heparin acts promptly but its effect in therapeutic doses seldom lasts for over three hours. It may be administered by intravenous or hypodermic injections; it is inert when given orally. It is also used in combination with dicoumarin (see COUMARIN), which begins to affect blood clotting only after a considerable delay but has a long persistence of action. When immediate results are desired, heparin will exert an antil clotting action until dicoumarin begins to act. The mechanism of action of heparin is still a moot question. It is said to interfere with the conversion of prothrombin to thrombin ("antiprothrombin action") and to antagonize the activity of the naturally occurring thromboplastic substances ("antithrombin action"). Since these actions are observed only in the presence of blood plasma, it must be supposed that the blood contains a substance, a "cofactor," that activates heparin. Heparin also appears to inhibit the clumping together and deposition of blood platelets (thrombocytes), a process that aids the formation and deposition of intravascular blood clots. The antil clotting action and the action on the thrombocytes adequately explain the beneficial action of heparin on thrombosis and embolism.

No anticoagulant can dissolve or dislodge the clots already formed. Heparin is useful because it prevents the formation and extension of blood clots. Numerous reports in the medical literature indicate that heparin not only reduces the incidence of intravascular clotting following operations and traumas but that it is also a lifesaving drug in many cases where thromboses and embolisms are already well developed. One of the most recent and most remarkable uses of heparin is in combination with penicillin for the treatment of subacute bacterial endocarditis. This was considered an almost certainly fatal disease, consisting of depositions of bacterial vegetations on the inner surface of the already diseased heart valves which further attract the deposition of blood clots. Death in subacute bacterial endocarditis is often due to the detachment of a thrombus carried by the blood stream to the brain ("cerebral embolism"). In the modern treatment of this dreaded affliction, heparin is used to check further depositions of clots on the heart valves, while penicillin actually rids the heart of the bacterial vegetations.

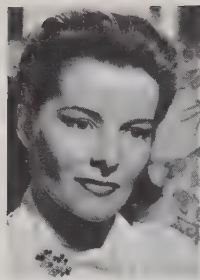
Heparin is a strongly acid substance, probably mucicetin polysulfuric acid. Its barium salt is crystalline and so powerful that 1 mg. prevents the clotting of 500 cc. of blood for a whole day. T. KOPFANYI

**HEPATICA**, a genus of plants belonging to the Crowfoot family. The two American species, *H. americana* (or *H. triloba*), and *H. acutiloba*, are common in woods from the east coast west to Minnesota and Missouri. Flowers of both species may be white, pink, or lavender. They bloom very early in spring before their first leaves unfold.

**HEPATITIS**. See LIVER.

**HEPATICAEE**. See LIVERWORTS.

**HEPBURN, KATHARINE**, 1909—, American actress, was born in Hartford, Conn. After her gradu-



MGM

Katharine Hepburn

ation from Bryn Mawr College, she joined the repertory company of Edwin H. Knopf in Baltimore and later studied under Frances Robinson-Duff and the dancer, Mordkin. Her first real success in *The Warrior's Husband* (1932) brought her Hollywood contracts and she went to California to make several films, among them *Little Women* (1933). *The Philadelphia Story* (1939) established her fame as an actress on the legitimate stage. *Dragon Seed* (1944), *Without Love* (1945),

and *Sea of Grass* (1947) were among her later films. *As You Like It* was well received on Broadway (1950) and on a road tour (1950-51).

**HEPBURN, WILLIAM PETERS**, 1833-1916, American congressman, was born in Wellsville, Ohio, was admitted to the Iowa bar (1845), and served during the Civil War with Sheridan and Rosecrans. Returning to Iowa (1867), he practiced law, was congressman (1880-86), solicitor of the treasury (1889-92), and was again congressman (1893-1909), for 14 years being chairman of the Committee on Interstate and Foreign Commerce. His main work was the Hepburn rate law of 1906 and his joint authorship of the Pure Food and Drug Act of 1906.

**HEPBURN ACT OF 1906** was designed to increase the power of the Interstate Commerce Commission through the control of rates. The law empowered the Commission to determine just and reasonable maximum rates not only for railroads but express and sleeping car companies, pipe lines, spurs, tracks and terminals. Orders from the Commission were enforceable without court action, compelling carriers to initiate litigation if they wanted to challenge the Commission's power. The Elkins Act of 1903 prohibiting rebates was reinforced. Free passes were restricted and corrupt expenditures exposed.

**HEPBURN v. GRISWOLD**. See SUPREME COURT OF THE UNITED STATES, *The Legal Tender Cases*.

**HEPHAESTUS**, identified by the Romans with their god Vulcan, was in Greek mythology the god of fire, and of all the arts, especially the working of metals which depend on the use of fire. He was the son of Zeus and Hera. Because of his lameness, he was the laughing-stock of the other gods, and was so disliked by Hera that she cast him forth from heaven. He then dwelt for nine years beneath the ocean with the marine deities. He made the armor of Achilles, the fire-breathing bulls of Aëtes, and other wonders. Lemnos was his favorite place on earth; but other volcanic islands—Lipara, Imbros, and Sicily—are particularly associated with him. In the *Odyssey* his wife is APHRODITE, who betrayed him for Ares.

**HEPPEWHITE, GEORGE**, d. 1786, English cabinetmaker, settled at St. Giles, Cripplegate, London. His delicate, graceful furniture, with its tapering legs and its inlaid or painted decoration, exerted great influence on English cabinetmaking. In 1788 his designs were published as *The Cabinet Maker and Upholsterer's Guide*.

**HEPTARCHY**, the name sometimes applied to the seven kingdoms supposed to have been established by the Angles, Saxons, and Jutes in England. The term is completely misleading if it be taken to mean that there were neither more nor less than seven distinct kingdoms in the country down to the time of Egbert; but is permissible enough if taken to mean only that the chief kingdoms at various periods from the fifth to the ninth century were Wessex, Sussex, Kent, Essex, East Anglia, Mercia, and Northumbria. See ENGLAND.

**HERA**, called Juno by the Romans, was in Greek mythology the wife and sister of Zeus, and the patroness of marriage and childbirth. Homer ascribes

to her a jealous, quarrelsome, and obstinate disposition. She pursues with unrelenting hatred the mistresses of Zeus and their children, especially Hercules and Dionysus, and even plots with Poseidon and Athena to put Zeus in fetters, for which she is beaten and otherwise punished by him. She bore to him ARES, HEPHAESTUS, and HEBE. In legend she is conspicuous especially for her aid to the Greeks in their wars with the Trojans, against whom she was embittered because PARIS in his famous judgment pronounced her beauty inferior to that of Aphrodite. She was worshiped throughout Greece, but especially at Olympia, Samos, and Argos. She is represented in art as a woman of majestic beauty, with large eyes—Homer often calls her "oxeyed"—and a noble expression.

**HERACLEA**, the name of more than a dozen ancient Greek towns, the most important of which are: (1) Heraclea in Lucania, southern Italy, on the northwest coast of the Gulf of Taranto, near the modern town of Policoro. It was founded in 432 B.C. by Tarentum and Thurii on the site of Siris. Near here in 280 B.C. Pyrrhus defeated the Romans, with whom an alliance was formed two years later. The city disappeared during the Middle Ages. Near it was found the Tabulae Heracleenses, or bronze tablets inscribed with municipal regulations according to Julius Caesar's law of 45 B.C. (2) Heraclea, or Minoa, was a Greek colony on the southern coast of Sicily, between Selinus and Agrigentum, at the mouth of the Halycus River. Minoa, a small colony, was established by Selinus and later seized by Euryleon of Sparta, who changed its name to Heraclea. In the first Punic War it was one of the chief naval stations of the Carthaginians. It is now called Platani. (3) Heraclea Pontica, now the modern Turkish town of Eregli, on the southern shore of the Black Sea, was a colony from Megara founded in 550 B.C.; the people of Tanagra in Boeotia also shared in the founding. In the Roman wars against Mithridates, it was plundered and burned by Aurelius Cotta. The modern town is known for its coal mines. (4) AYVALIK, a seaport of western Turkey, was also called Heraclea in ancient times.

K. E. H.

**HERACLITUS**, c. 576-480 B.C., early Greek philosopher of the Ionian school at Ephesus. His chief theories were that fire, or rather heat, is the cause and inherent principle of all existence, and that everything in the world is in a state of flux or motion. Zeller calls him "the first philosopher who emphatically proclaimed the absolute life of nature, the ceaseless change of matter, the variability and transitoriness of everything individual; and, on the other hand, the unchangeable equality of general relations, the thought of an unconditioned, rational law governing the whole course of nature." Because of his laments over the folly of mankind, Heraclitus was known as "the weeping philosopher," in contradistinction to the laughing Democritus. He wrote *On Nature*, only fragments of which have been preserved. His philosophy is known through these fragments and through Plato and Aristotle, who gave accounts of his teachings.

**HERACLIUS**, c. 575-641, East Roman (Byzantine) emperor from 610 to 641, was born in the province of Cappadocia. After defeating and slaying Emperor Phocas, he ascended the throne. The barbarian Avars threatened him from the Danube and the Persians from the East. Heraclius, by a display of force and by bribery, concluded a treaty with the Avars (620) and then turned against the Persians, who had conquered Syria, Jerusalem, and Egypt and had finally invaded Asia Minor as far west as the Bosphorus. He reconquered Jerusalem and Syria and in a series of campaigns rolled back the tide of the Persian invasion. During that war he recovered the true cross, which he returned to Jerusalem in 629, the year after he had made peace with Persia.

The elimination of Persia as a major power opened the way to the Arabs. Within a few years they con-



quered Syria (634), Palestine (637), and Egypt (641), defeating Heraclius' generals one after the other. The Emperor, suffering from a kidney ailment, did nothing against the mounting tide of the Arabian invasions but vented his wrath over his defeats on the Jews. During his reign the Greek language finally replaced Latin as the official language in all administrative matters.

**HERAEUM**, the temple of Hera in Argolis, about six miles N of Argos. It was burned to the ground in 427 B.C., and rebuilt with great magnificence. Polycleitus, the sculptor, enriched it with a colossal statue of Hera. The site was excavated by the American school in Athens between 1892 and 1895, the results being published in the *American Archaeological Journal*.

**HERAKLEIA**. See CYCLADES ISLANDS.

**HERAKLEION**, or **Candia**, largest city, Crete, on the N coast of the island, and capital of the department of Herakleion. The shallow harbor, which is formed by two moles that terminate in medieval forts, is used only by small vessels. The town has a noteworthy museum of antiquities and bazaars, mosques, and public baths. Ancient city walls, an arsenal, and traces of other ancient buildings erected by the Venetians remain. The medieval cathedral of St. Titus was demolished in 1880; a new Greek cathedral was consecrated in 1893. Inhabitants of the town today are chiefly Greeks, with a few Moslems and Jews. Exports are farm produce, oil, and soap.

The ancient town, Candia, was founded in 823 B.C. by the Saracens; later it became Grecian. From the 13th century it was held by the Venetians. It withstood a famous siege (1667-69), when the Turks captured it from the Venetians. An earthquake in 1856 almost destroyed the town. It was bombed by the Germans in a mass plane attack in May, 1941, during their invasion of the island, and again by the Allies in 1944. The museum and much of its contents were damaged. With other towns of the island it was liberated in 1945. Pop. (1950 est.) 35,000.

**HERALDRY**, the science of decorating coats of arms. Called armorial bearings, modern heraldic devices date from the Middle Ages, although badges and emblems were used on shields and helmets in Greek and Roman battles, and even the Bible refers to such decorations. It was during the many medieval wars that heraldic devices became a necessity, for not until that time was the knight completely covered with a suit of armor that not only protected him from harm by the enemy but also from recognition by his own men. In order to distinguish more easily between each other the knights began placing small designs on their shields. By the end of the 12th century this practice had become widely accepted and a knight's individual markings were depicted not only on his shield but on all parts of his equipment—on his banner, the covering of his horses, and on the peaks of his saddle. Even his tomb was decorated with the distinguishing emblems. Richard Coeur de Lion was the first English king known to bear a coat of arms, and like him many knights chose the lion, a symbol of courage, as their emblem. The crest, worn on the top of the helmet and in later drawings depicted at the top of the shield, was another symbol of valor or high rank.

After a few years there were so many repetitions of the same designs among the knights that authorities had to be appointed to keep records of the coats of arms. These men were called heralds. By the reign of Henry V there were so many different heraldic devices in England that the king prohibited all Englishmen who had not displayed coats of arms at the battle of Agincourt from assuming them unless by hereditary descent or with the sanction of the society of heralds. At tournaments it was the duty of the appointed herald to *blasen* or sound a trumpet and describe the armorial bearing of each participant in order to identify him. The term "blazon" developed from this custom and means an explanation of a coat

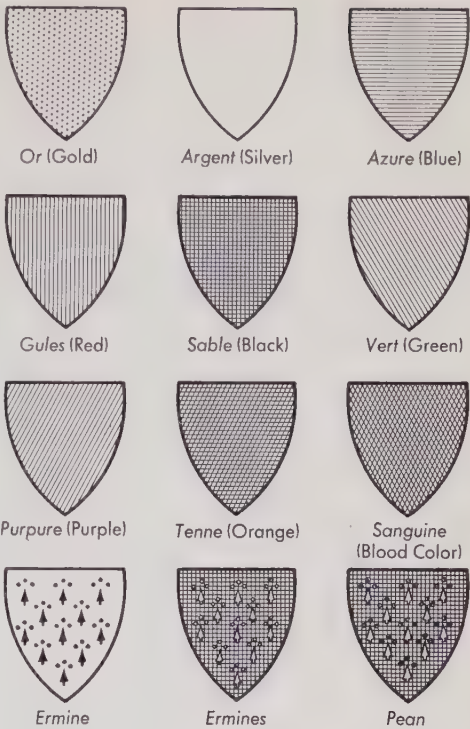
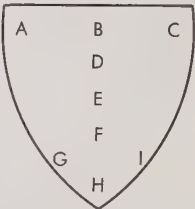


Fig. 1 (above). Patterns symbolizing the tinctures

Fig. 2 (right). Points of Shield. A, dexter chief; B, middle chief; C, sinister chief; D, collar or honor point; E, fess point; F, nombril point; G, dexter base; H, middle base; I, sinister base



of arms. Many specialized heraldic terms were originated and employed to give clear meaning to the identification of the heraldic devices.

**Rules of Blazon.** The surface of the shield is called the field and may be painted one or more colors. These colors are known as tinctures and have special names, many of them descended from old French terms. Conventionalized patterns symbolize the furs and metals that are also used in fields. When drawn, these backgrounds are represented with certain lines as in Fig. 1. The decoration on the shield is termed the charge. In order to indicate the position of the charges the shield is divided into parts, called the points of the shield (Fig. 2). For the knight carrying the shield, the dexter side is always on the right, the sinister on the left. These divisions are often differentiated by the partition lines shown in Fig. 3, and by three types of straight lines—the perpendicular, the horizontal, and the diagonal. They are also used as border (bordure) lines around the edge of the shield.

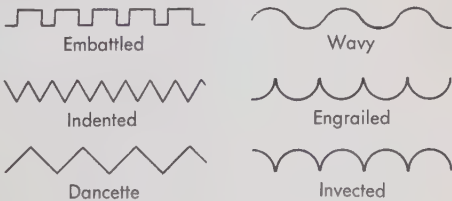
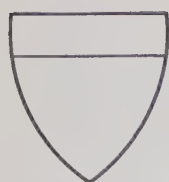


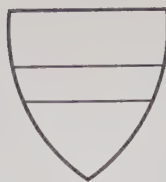
Fig. 3. Partition lines



The Chief



The Fesse



The Bar



The Pale



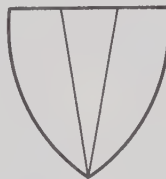
The Cross



The Bend



The Saltire



The Pile



The Chevron



The Pallet



The Bar



The Bendlet



The Orle



The Tressure



The Chevronel



Inescutcheon



The Canton



The Gyron



The Lozenge



The Billet



The Fret



The Roundel



The Bordure



Flanches

Fig. 4. The honorable ordinaries and subordinaries

**Charges.** The most frequently used decorations in heraldry are subdivided into ordinaries and subordinaries. There is no known reason for the division and many authorities disagree as to their exact classification. The ordinaries are shown in the first eight shields of Fig. 4. Sixteen of the most common subordinaries follow them. Animals and designs taken from nature are favorite heraldic devices. Among the most interesting are the fabled monsters such as the dragon, the griffin, the wyvern, and the unicorn. The most popular of the more ordinary animals is the lion. Each of the postures the lion is depicted in has a special term as illustrated in Fig. 5. Trees occupy an important part in heraldry. In England the Penderells, who hid Charles II in the oak after the battle of Worcester, were granted an oak tree for their coat of arms. Such additions to the arms of an individual which were made by sovereigns as a recognition of services are termed augmentations.

**Cadency and Marshalling.** To differentiate the coat of arms of the head of a house from the other members of his family was long a burning question in heraldry, and was called cadency. It was not

Eldest Son



Label

II



Crescent

III



Mullet

IV



Martlet

V



Annulet

VI



Fleur de lys

VII



Rosa

VIII



Cross Moline

IX



Double Quatrefoil

Fig. 6. Cadency



until the 16th century that a permanent system was adopted. At that time a distinguishing mark or device was appended to the shield of each son in strict accordance with the order of his birth (Fig. 6). The problem of combining the coat of arms of a wife who is an heiress (the sole descendant of her family and therefore entitled to the coat of arms) with that of her husband was solved in a number of ways. The earliest method of displaying the alliance was by placing the coat of arms of a husband and wife side by side in separate shields. Then came the methods of dimidiation, by which the dexter half of the husband's arms were joined to the sinister half of the wife's; and impaling, by which the entire coats of each are depicted on one shield. Quartering came into use in the 13th century. The husband's coat is placed in the first and fourth quarters; the wife's in the second and third. The arrangement of two or more coats on a shield is called marshalling. There is usually a great deal of marshalling on the armorial bearings of a nation or state, such as in the British coat of arms. The shields of maids and widows are in the form of a lozenge.

After occupying for ages the attention of the learned and forming an important branch of a princely education, the study of heraldry has fallen into neglect. Only in Great Britain is it of any importance today. Coats of arms are now more often emblazoned on stationery than they are on shields. See ESCUTCHEON.

M. R.

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**HERAT**, chief city of NW Afghanistan, just N of the Hari River, about 400 miles from the Iranian and Russian frontiers. It is a center for trade routes, although Herat no longer has its ancient commercial importance. A high wall, rising 25 feet above an earthwork about 50 feet in height, surrounds the city. Many ruins dot the surrounding fertile valley. Herat's

founder and the time of its founding are not known, although the wall indicates that the city is very ancient. Destroyed (1157) by the kings of Ghazni, Herat was restored by the kings of Ghor but fell before Genghis Khan in 1232 and Tamerlane in 1398. By the 15th century it was again a flourishing city. Herat succeeded in warding off Persian dominance through the aid of Great Britain, which finally compelled Persia to recognize by treaty in 1857 the independence of Herat. In 1863 the king of Kabul, Dost Mohammed, brought the city into the Afghan monarchy. Pop. (1948 est.) 75,632.

**HÉRAULT**, department, SE France, between the Cévennes (mountains) and the Mediterranean Sea; area 2,402 sq. mi.; pop. (1946) 461,100. Two rivers, the Orb and the Hérault, divide it into three parts, each with a mountainous region, a belt of hills, and a low plain. Along the shore are lagoons. To the northwest are the Cévennes. Between the Orb and the Hérault is the chalky region, Causse de Larzac. Hérault is a rich agricultural department producing much wine and olive oil. Silk worms are bred. Among the minerals are coal and zinc, and salt is produced along the seashore. Stone, marble, and lime are quarried. The Canal de Midi runs through the southern section of the department and terminates at the port city of Sète. There are numerous health resorts. The capital is MONTPELLIER. Hérault is a part of the former province of LANGUEDOC.

**HÉRAULT RIVER**, ancient *Arauris*, SW France, rises in the Cévennes, flows S across the departments of Gard and Hérault, and empties into the Mediterranean, two miles below Agde. Its total length is about 120 miles.

**HERB**, in botany, a plant that normally dies down to the ground each year, as distinguished from those with woody stems that persist from year to year. Herbs may live one, two, or more years; that is, they may be annuals, biennials, or perennials. In popular usage the term *herb* is applied to those garden plants that are grown principally for their flavoring or medicinal value. The valued portion of the plant may

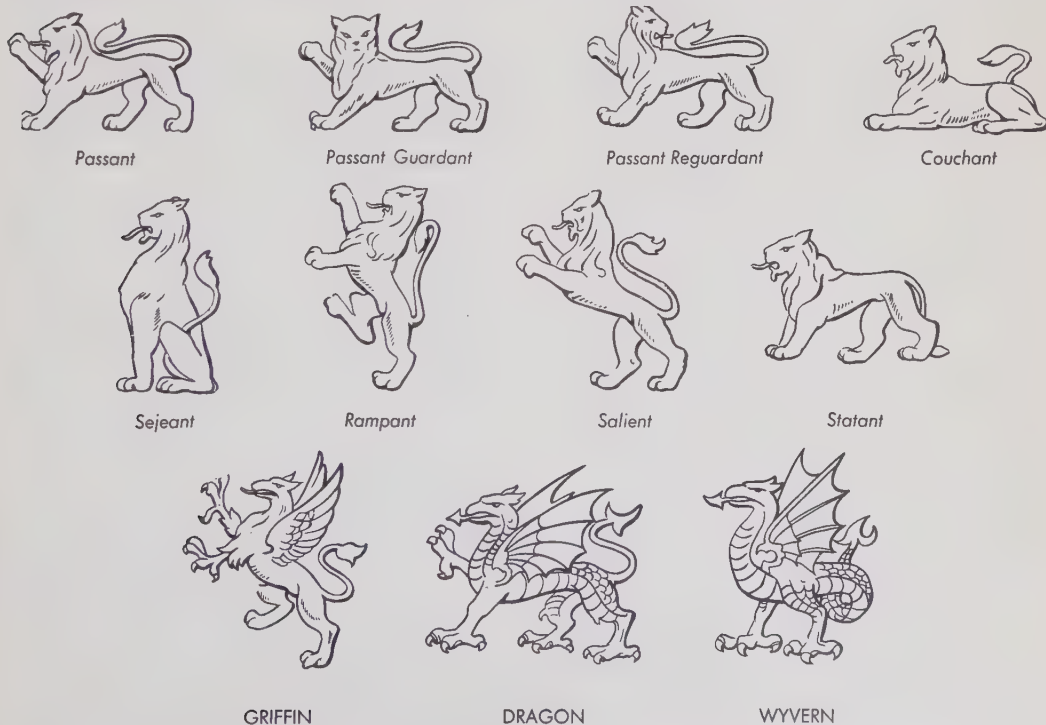


Fig. 5. Charges on shields: lion in various postures; fabled monsters in lower row

be the leaf, fruit, or root. Plants used for garnishing or for pot greens are sometimes classed as herbs, and the term is often further extended to include such subshrubs as rosemary and lavender.

As imparters of flavor, herbs are used in soups, salads, sauces, stews, stuffings, etc. Their judicious and discriminating use is generally considered one of the characteristics of superior cookery. The uses of herbs in medicine are the subject of considerable legendary lore, but it is difficult to say anything authoritative about their actual values in this field. Books on the medieval uses of herbs are discussed under **HERBAL**.

For descriptions of individual herbs, see **ANGELICA**; **ANISE**; **ARTEMESIA**; **BASIL**; **BORAGE**; **CARAWAY**; **CATNIP**; **CHERVIL**; **CHICORY**; **CHIVE**; **CORIANDER**; **CUMIN**; **DILL**; **ELECAMPANE**; **FENNEL**; **GINSENG**; **HOREHOUND**; **HORSERADISH**; **HYSSOP**; **LAVENDER**; **MARJORAM**; **MINT**; **PARSLEY**; **PENNYROYAL**; **PEPPERMINT**; **ROSEMARY**; **RUE**; **SAFFRON**; **SAGE**; **SAVORY**; **TANSY**; **TAR-RAGON**; **THYME**. C. C. G.

**HERBAL**, a book containing the names and descriptions of herbs, or of plants in general, with their medicinal properties. The chief works so named are *The Grete Herbal* (1526); R. Dodoens's *A Nieuwe Herbal*, trans. from the French by Henry Lyte (1578); Turner's *New Herbal* (1551); Gerarde's *Herbal* (1597); and Parkinson's *Theatrum Botanicum* (1640). The word herbal is also used to signify a collection of herbs or plants. See **GARDENS** and **GARDENING**.

**HERBARIUM**, a collection of dried plants preserved for comparison and study. The method of preservation is to dry the specimens between sheets of absorbent paper, under pressure, and mount them on stiff paper of uniform size. Some plan should govern the collection—the illustration of a botanical problem, the flora of a given district, variations, etc. Although the herbarium at the Royal Gardens at Kew, London, England, is the greatest of all dried-plant collections, being constantly added to by contributions and exchange, and containing many "type" specimens, there are several herbaria of high rank in the United States, besides many local and incomplete ones. One of the most famous is the Gray Herbarium at Harvard University, which contains many of the typical plants upon which the older collectors, including ASA GRAY himself, based their classifications. Another is that of the New York Botanical Garden, which is constantly and rapidly growing. It was originally at Columbia University, the scene of the labors of the earlier New York botanists, and has allied with it such local collections as that of the Torrey Botanical Club. The Chicago Museum of Natural History and the Missouri Botanical Garden at St. Louis also have valuable herbaria. The United States National Herbarium contains material gathered during the early western surveys, and also a vast amount brought in by governmental collectors. All of these are richer in American species than in European; but many of the older American types are contained in the great French collection at the Jardin des Plantes, in Paris. Geneva, Vienna, and Leningrad also have international herbaria. The Berlin herbarium was destroyed in World War II.

**HERBART, JOHANN FRIEDRICH**, 1776–1841, German philosopher, was born in Oldenburg, and studied in Jena under Fichte. For a time he was a private tutor in Switzerland, where he visited the educator Pestalozzi at Burgdorf, and was appointed professor at Göttingen in 1805. In 1809 he was called to Königsberg, and remained there until 1833, when he was recalled again to Göttingen. His metaphysical system has a certain resemblance to that of Leibnitz, in that he regards the universe as a plurality of ultimate and independent units. But the "reals" or metaphysical units of Herbart, unlike the monads of Leibnitz, are perfectly simple qualities. The appearance of complexity arises only when the reals are regarded externally in relation to each other; it does

not belong to their inner being. Apart from its metaphysical basis, his psychology resembles that of the English associationists, though he goes beyond them in attempting to express psychological processes in terms of mathematical formulas. His psychology was the most effective part of his system, and has contributed much to the progress of the science. Through the doctrine of apperception in particular, the Herbartian psychology has exercised a powerful influence on educational theory. His *Sämmtliche Werke* appeared in 12 vols. (1850–52). See **EDUCATION**.

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**HERBERT, EDWARD, BARON HERBERT OF CHERBURY**, 1583–1648, English philosopher, historian, and diplomat, was born in Eytton-on-Severn, Shropshire. He took part in the war in the Low Countries (1610, 1614) and was ambassador to France (1619–24). The last 23 years of his life were spent in retirement. Herbert made a systematic attempt at a comparative study of religions, but he looked upon all historical religions as corruptions of pure rational worship. His views greatly influenced the deistic movement of the 18th century. (See **DEISM**.) He anticipated the critical method by means of which Kant later gave a new direction to thought, emphasizing an antiempirical approach to all knowledge. His philosophy greatly influenced the English 18th century deists and John Locke. His most important philosophical work was *De Veritate* (1624). Other works include *Life and Reign of King Henry VIII* (1649); *Poems* (1665); *Dialogue Between a Tutor and His Pupil* (1768); *Autobiography* (1764).

**HERBERT, GEORGE**, 1593–1633, English poet, younger brother of EDWARD HERBERT, was born in Montgomery Castle, Wales. He was educated at Cambridge, and taught there (1618–27). Under the influence of the theologian Nicholas Ferrar, he entered religious life, was ordained (1630), and received the benefice of Bemerton, in Wiltshire. His verse, collected in *The Temple* (1633), consists of 160 devotional poems remarkable for their quaint conceits and curious imagery. In prose, he wrote *A Priest to the Temple*, which Izaak Walton characterized as "plain, prudent, useful rules for the country parson."

**HERBERT, HENRY WILLIAM**, 1807–58, American novelist, was born in London, England, and educated at Cambridge. He came to the United States in 1831, taught Latin and Greek at schools in New Jersey and New York, and founded the *American Monthly Magazine* (1833). Generally under the name of Frank Forester, he wrote many books on shooting, fishing, and adventures connected therewith, such as *The Warwick Woodlands* (1845), the first American sporting novel; *The Field Sports of the United States and British Provinces of North America* (1848); *Frank Forester and His Friends* (1849); *The Quorndon Hounds* (1852); *The Complete Manual for Young Sportsmen* (1856). He also wrote a number of historical novels, beginning with *The Brothers, a Tale of the Fronde* (1835), and in his later years published various historical studies and translated several novels of Sue and Dumas. His second wife deserted him shortly after their marriage, and he committed suicide.

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**HERBERT, HILARY ABNER**, 1834–1919, American lawyer and cabinet officer, was born at Laurensville, S.C., and practiced law in Alabama. During the Civil War, he served with the troops of that state, and was disabled in the Battle of the Wilderness. He was a representative from Alabama in the Congresses from the 45th to the 52d inclusive, and was secretary of the navy 1893–97. He obtained support for his shipbuilding program despite the depression.

**HERBERT, VICTOR**, 1859–1924, American cellist, conductor, and composer, was born in Dublin, Ireland. Sent to Germany at the age of seven to study music, he entered the Stuttgart Conservatory and



later toured the Continent as a cello soloist. From 1883 to 1886 Herbert was first cellist with the Court Orchestra at Stuttgart and it was during this time that he first began to compose. Marriage to the prima donna of the Court Opera in Vienna, Therese Foerster, in 1886, brought the young musician the position of first cellist in the Metropolitan Opera House, New York, through the influence of his wife. In America Herbert became popular as a guest conductor and soloist and in 1898 he was appointed director of the Pittsburgh Symphony Orchestra. The first of his sparkling operettas, *Prince Ananias*, was written in 1894 at the suggestion of William MacDonald, manager of the Bostonians. The production was so successful that Herbert devoted himself almost entirely to light music-dramatic works for the rest of his life. His two attempts at serious opera, *Natoma* (1911) and *Madeleine* (1914), lacked the mastery he showed in the spontaneous and appealing tunes of his less presumptuous compositions. His orchestral works include the *Irish Rhapsody* and *Suite of Serenades*, composed for Paul Whiteman, who played it at his Aeolian Hall Concert in 1924. Among his light operas are *Babes in Toyland* (1903), *The Red Mill* (1906), *Naughty Marietta* (1910), and *The Dream Girl* (1924). In 1904 Herbert retired as conductor of the Pittsburgh Symphony Orchestra, accepted only invitations as guest conductor and became well-known in Broadway theatrical circles. He was one of the founders of the American Society of Composers, Authors and Publishers.



Victor Herbert

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**HERBERT, WILLIAM**, 3rd **EARL OF PEMBROKE**, 1580–1630, English poet, was born in Wiltshire and studied at New College, Oxford. He was banished from court in 1601 for an illicit affair with Mary Fitton, a maid-of-honor of Elizabeth, but returned to favor under James I and served as lord chamberlain (1615–25). He was appointed lord steward by Charles I and, as a member of the committee on foreign affairs, interested himself in the Northwest Passage, Virginia, the East India Company, and other projects. He was chancellor of Oxford University from 1617 and gave his name to Pembroke College (1624). A minor poet and a lifelong student of literature, he was a patron of Jonson, Massinger, and Shakespeare, and maintained a company of players, the Earl of Pembroke's Men (afterwards the Lord Chamberlain's Players), who gave early performances of the works of Shakespeare and other Elizabethan playwrights. The First Folio of Shakespeare (1623) is dedicated to him and his brother Philip, "the incomparable pair of brothers," and he is identified by some scholars with the "Mr. W. H." to whom Shakespeare dedicated his sonnets.

**HERBIVORE**, a plant-eating animal. Herbivores are commonly found among the insects, birds, and mammals, the most familiar forms being hoofed animals, such as deer, sheep, cattle, goats, etc. Their specialized existence has led to a variety of adaptations (see **ECOLOGY**). Many plant feeders are highly specific, that is, they eat only one species of plant. An example of such a herbivore may be seen in the larva of the pipe-vine swallowtail butterfly, *Papilio philenor*, which feeds only on the Dutchman's-pipe. Others are only moderately specific in their food habits, eating a number of species of plants of the same type. Among these are the grazing animals that eat grasses, the browsers that feed on leaves and twigs, flower feeders, bark feeders, and many others. The majority of herbivores, however, are nonspecific and eat plants of any kind. Because of their versatility, they are

better able to adjust to changing conditions and therefore are more dominant in any community.

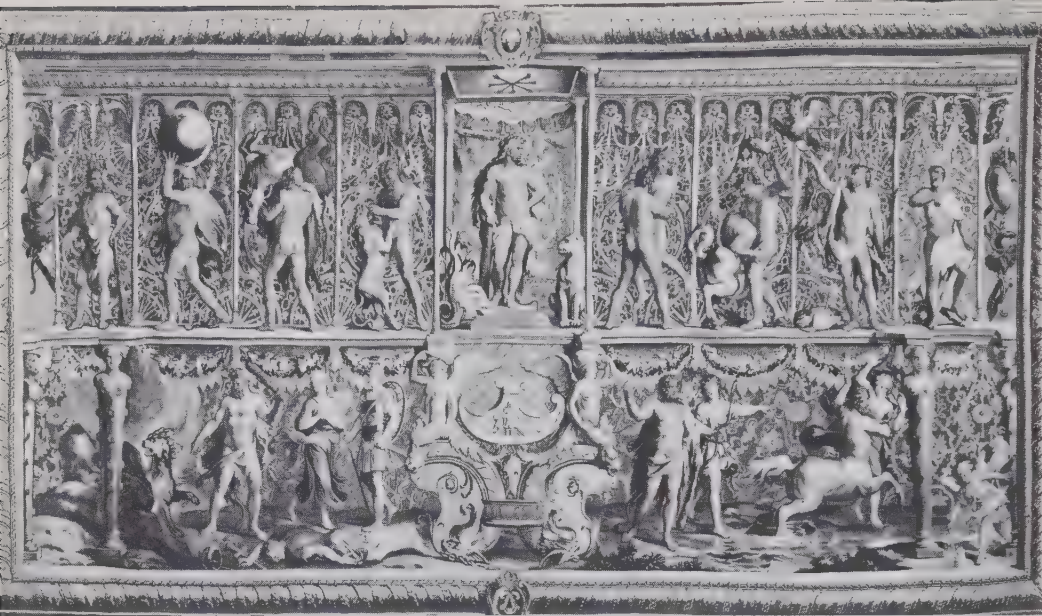
**HERCEGOVINA**. See **BOSNIA-HERCEGOVINA**.

**HERCULANEUM**, ruined city of Italy, lay at the W foot of Mount **VESUVIUS**, five miles SE of modern Naples. Originally founded by the Oscans, and held by the Etruscans, it was captured by the Romans in the Social War of 89 B.C., and made a colony. It was overwhelmed by eruptions of the volcano 63, 79, and 472. The ancient city was accidentally discovered in 1711–19, and excavations have been carried on, but intermittently, since 1737. The work is difficult, as the greater part of the city lies under modern villages, and can only be excavated by tunneling through a tough tufa. Most of the treasure-trove, papyrus MSS, vases, and domestic utensils, are now in the museum at Naples. See **ARCHAEOLOGY**, *Findings at Pompeii and Remains of Early Roman Settlements*.

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**HERCULANO DE CARVALHO Y ARAUJO, ALEXANDRE**, 1810–77, Portuguese poet and historian, born in Lisbon. In 1828–32 he lived in Paris and London, to escape the despotism of Dom Miguel. His first poetical production was *A voz de propheta* (1836), followed in 1838 by the collection of poems *A harpa do crente*. Inspired by Scott, he published a series of "national" novels, as *Eurico o presbytero* (1843), *O monasticon* (1844–48), and *O monge de Cister* (1848). Not only did he inaugurate a national school of poetry and romance writing, but he also applied modern historical methods to the history of his country in his *Historia de Portugal* (4 vols. 1845–52), and *Da origem e estabelecimento da Inquisição em Portugal* (2nd ed., 3 vols., 1864–72).

**HERCULES**, or **HERACLES**, a demigod worshiped by the Greeks and Romans, is the most heroic figure in classical mythology. The son of Zeus by **ALCME**NE, the wife of Amphitryon, he was endowed with supernatural strength. His life was constantly complicated by the enmity of the goddess Hera, by his many love affairs, and by attacks of divine madness, during one of which he murdered his own children. To expiate this crime he was commanded by the Delphic oracle to become the bondsman of Eurystheus, the king of Argos. The tasks imposed upon him by Eurystheus, "the 12 labors of Hercules," include: (1) the slaying of the Nemean lion; (2) the slaying of the hydra of Lerna; (3) the capture of the Arcadian stag; (4) the capture of the boar of Erymanthus; (5) the cleansing of the Augean stables; (6) the slaying of the Stymphalian birds; (7) the capture of the mad Cretan bull, which Poseidon had sent to Minos; (8) the capture of the mares of Diomedes; (9) the theft of the girdle of Hippolyte, queen of the Amazons; (10) the capture of the oxen of Geryon; (11) the quest of the apples of the **HESPERIDES**; (12) the carrying off of **CERBERUS**, the hound who guarded the gates of hell. This is the legend found in Homer, Hesiod, Pisander, and other early poets. The story of his death, related by later writers, was that in the agony caused by the poisoned robe of the Centaur Nessus, sent to him as a love charm by his wife **DEIANIRA**, he threw himself onto a funeral pyre on Mount Oeta. Heracles was especially honored by the Dorians; the royal houses of Argos, Sparta, and Messene all traced their descent from him. The cult of his Roman counterpart, Hercules, dates from about 400 B.C. As a personification of strength, he is related to the Phoenician Melkarth and to the Celtic deity, Ogmios. Besides figuring in the epic poems of Homer and Hesiod, he is the subject of the *Heraclidae* of Pisander of Camiros, the *Heraclea* of Panyasis, the *Trachiniae* of Sophocles, the *Hercules Furens* of Euripides, and other works. In art, Hercules is represented as the type of masculine power and vitality, with muscular limbs, curly hair, and a rather small head. He is often pictured wearing a lion's skin and carrying



PARKE-BERNET GALLERIES

"Triumph of Hercules," after a design by Noel Coypel, portrays Hercules accomplishing the 12 labors demanded by Eurystheus. This is one of a series of Royal Gobelin tapestries entitled "The Triumphs of the Gods"

a club. The most notable statue of the hero is the so-called Farnese Hercules, found in the baths of Caracalla in 1599, and now in the Naples museum. See MYTHOLOGY.

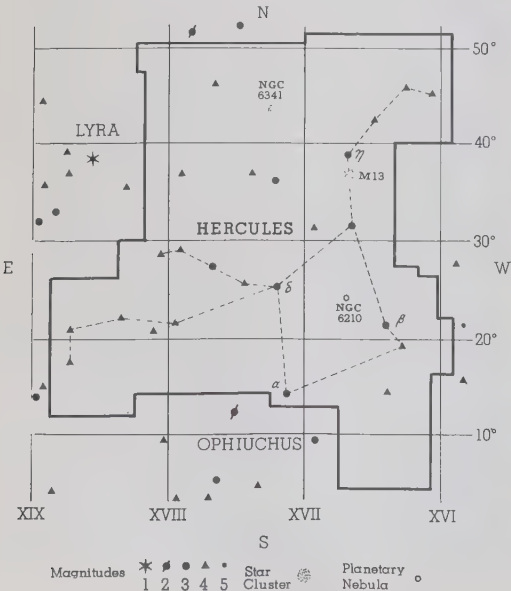
**J. J. M. HERCULES**, the Hero, a large northern CONSTELLATION that lies west and south of Lyra and is on the meridian at 9 P.M. late in July. Its brightest object is  $\alpha$  Herculis, a red VARIABLE STAR whose brightness ranges irregularly between MAGNITUDES 3.1 to 3.9. The constellation includes a number of binary systems (see DOUBLE STAR) that require more than 100 years for the revolution of the star pair about their common center of gravity, and many spectroscopic binaries, some of whose periods of revolution are as short as two days. Among interesting telescopic objects are the bright planetary nebula NGC 6210; the small but fine globular cluster NGC 6341; and the famous M 13, the great cluster in Hercules, thought by many

to be the most magnificent globular cluster in the sky. It is just visible to the unaided eye on a clear dark night. See ASTRONOMICAL CATALOGUES; GREEK ALPHABET.

**HERCULES BEETLE**, a beetle remarkable for its large size, the male sometimes reaching a length of over five inches. It is native to the West Indies and tropical America. The male bears on the thorax an enormous horn, which is met by a shorter upturned horn from the head, the whole resembling a pair of large but somewhat unequal pincers.

**HERCULES' CLUB**, a plant. See ARALIA.

**HERCULES, PILLARS OF**, the two rocks which form the western entrance to the Mediterranean Sea, Calpe (the Rock of GIBRALTAR) and Abyla (Ceuta). Ancient authorities, as Mela and Pliny, considered that the pillars were rocks torn asunder by Hercules, so as to open the Atlantic Ocean into the Mediter-



LICK OBSERVATORY

The globular cluster M13 in Hercules



ranee; others again, that he once joined them to make a bridge, or fixed them to narrow the strait and to exclude the monsters of the ocean, or that he set them there as a memorial.

**HERDER, JOHANN GOTTFRIED VON, 1744–1803**, German philosopher, writer, and theologian, was born in East Prussia. He studied theology at Königsberg (1762–64), taught school at Riga, and took orders (1767). He was at Strasbourg in 1771, where he exerted considerable influence on Goethe, and the same year became court preacher at Bückerburg. In 1776 Goethe secured for him a similar appointment at Weimar, which he held until his death.

Herder became a critic of Kant, under whom he had studied at Königsberg, and wrote extensively in the fields of theology and philosophy, as well as philology, history, and mythology. His outstanding work is *Ideen zur Philosophie der Geschichte der Menschheit* (1784–91), which traces the history of mankind up to the Crusades. Other works include *Kritische Walder* (1769), which supplements the critical works of Lessing; *Abhandlung über den Ursprung der Sprache* (1772), a work on comparative philology; *Stimmen der Völker in Liedern* (1778–79), a collection of folk songs and poetry; *Briefen zur Beförderung der Humanität* (1793–97); and a paraphrase of the *Cid* (1803).

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**HEREDIA, JOSÉ MARIA DE, 1842–1905**, French poet, born near Santiago de Cuba, of mixed Spanish and French blood. With Coppée, Sully-Prudhomme, Verlaine, and others, he formed the group of innovators surrounding Leconte de Lisle, known as “Les Parnassiens.” The watchword of the school was “form,” technical perfection being held of supreme importance. Heredia’s sonnets, collected under the title of *Les Trophées* (1893), reveal his mastery of the form. He was elected to the Academy in 1894.

**HEREDIA**, city, Costa Rica, capital of the province of Heredia, five miles W of San José. Well located on mountain foothills, at an altitude of 3,741 feet, it has an excellent climate. It is a picturesque city of tile-roofed adobe houses set in colorful gardens. Large-scale coffee plantations stretch over the adjoining countryside. Other parts of the province are devoted to fruit growing and the grazing of cattle. Pop. (1950) 11,000.

**HEREDITAMENT**, anything inheritable (i.e., which would pass on the owner’s death to the heir and not to the personal representative), whether personal in its nature, as an heirloom, or real, as a fee-simple estate in land. Hereditaments are either *corporeal* (i.e., such as involve the possession of land, as a freehold estate) or *incorporeal* (as an easement, which, being an interest in another’s land, does not carry with it any right of possession). The term is one of the technical terms of conveyancing and is now seldom met with except in deeds and wills in the formula “lands, tenements, and hereditaments.” See **INHERITANCE**.

## HEREDITY ♦ Man’s Biological Inheritance Transmitted by Genes

*A biologist explains why children resemble their parents—and why they don’t*

**HEREDITY**, as it applies to man, usually has two meanings. A man may inherit a house or a sum of money, his social inheritance; or he may inherit such traits as blue eyes, brown hair, a particular skin color, his biological inheritance. In a sense neither the items of his social inheritance nor the traits of his biological inheritance are transmitted as such. For his house or sum of money, he receives pieces of paper, the title to his house or bills representing money; for his inherited physical and mental traits he receives *hereditary units or genes* that are passed along from generation to generation by sex cells. In his biological inheritance man receives equally from his male and female parents hundreds of genes, which determine his development and behavior.

The mechanism of heredity, i.e., the biological transmission of genes from parent to offspring, results in a resemblance between related organisms. This is more apparent in plants and lower animals where there are numerous offspring, all apparently alike. Similarly, the members of human families may also show striking resemblances. Close as these resemblances may be, however, no two individuals are usually ever exactly alike. People are familiar with the vast differences among the individuals they know and see at every turn. They are aware of the extreme variations in the breeds of plants and animals, both wild and domestic. Differences among sexes and individuals are obvious, for sons are not identical with their fathers nor daughters with their mothers. Even identical boy or girl twins, who may appear to be as alike as peas in a pod, show points of difference when they are carefully studied. These are especially noticeable if the twins are separated and each matures in a different environment. Such differences between individuals are known as *variations*.

The study of the mechanisms of heredity and variation, as well as that of the causal relationship between the two phenomena, constitutes a branch of the biological sciences known as *genetics*. In his attempts to discover how an organism inherits certain traits the geneticist finds it necessary to determine and evaluate the important influence of the particular environment, both internal and external, in which the organism develops. There are a number of reasons for this. First of all, the hereditary factors or genes cannot act in a vacuum. Secondly, genes do not produce their effects singly but work in combinations, and these combinations are constantly being modified during embryonic life by internal forces, such as temperature, humidity, sunlight, diet, type of shelter, etc. Finally, in the case of man, social conventions exert forces of utmost importance. Genetics, then, is not merely the

study of the mechanics of inheritance, although heredity is the central theme of the subject. The geneticist aims to state as accurately as possible the results or reactions of specific genes and gene combinations under specific environmental conditions. When the geneticist is asked “Which is more important, heredity or environment?” he will probably say, “What hereditary factor are you referring to,

**Chromosomes in a salivary gland cell of a fruit fly**

DR. BERWIND P. KAUFMANN  
CARNEGIE INST. OF WASHINGTON



and what environment will be available for the development of that hereditary factor?"

**Mendel's Experiments.** The gene theory of inheritance, indeed the science of genetics, stems from the revolutionary studies and interpretations of GREGOR MENDEL. In a little strip of land, hardly larger than a city back yard, Mendel, an Austrian monk, labored painstakingly for many years on hereditary experiments with sweet pea plants. The principles of inheritance which he announced in February and March, 1865, are as sound today as when he first proposed them to an unappreciative, scientifically unprepared world. It was not until 1900, however, that they were widely read and appreciated.

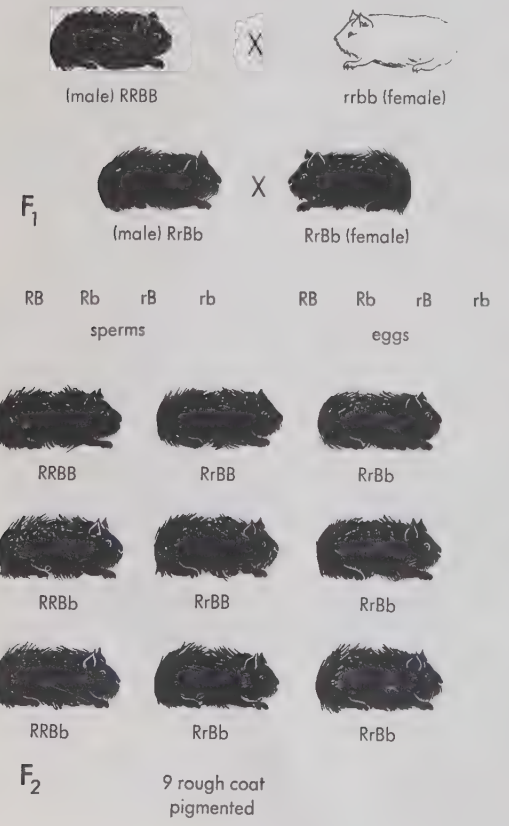
Mendel spent two years in testing his plants for purity, so that he knew each plant used in the experiments belonged to a race that had bred true to type. He picked out easily recognizable characters, such as size and color, for his experiments and chose those features that were opposed to each other, such as yellow pod-producing sweet peas in contrast to green pod sweet peas or tall plants as opposed to dwarf plants. In the beginning each contrasting plant character was treated separately. Later two or more inherited characteristics were combined and the more complicated results predicted accurately. In all, Mendel used seven contrasting features in the sweet pea.

In addition to the many clear-cut characters of color and size differences, the sweet pea was chosen deliberately by Mendel because the plant had a type of flower, its reproductive system, that a skilled worker could manipulate. Ordinarily the sweet pea is self-pollinating and self-fertilizing, and natural agents, such as wind and insects, that effect cross-pollination in other kinds of flowers, play no part in the sweet pea's system of reproduction. When Mendel wished to cross a short-stemmed sweet pea with a tall one, he delicately removed the undeveloped stamens from the short plant's flower. Then, by an equally delicate operation, he placed the ripe pollen grains that he

had removed from a tall plant's flower upon the stigma of the short sweet pea's flower. This amounted to mating a "short" female with a "tall" male plant. Mendel harvested the seeds of these artificially pollinated short sweet peas, planted them, and found that all the seeds developed into tall plants. This indicated that the tall plant's pollen had effectively suppressed the short plant's normally expressed characteristics. Mendel called these plants tall *hybrids*, even though they were indistinguishable from the ordinary true-breeding tall sweet peas. Mendel again mated the tall and short plants but used pollen from the short plant and placed it on the tall plant's stigma, thereby mating a "tall" female with a "short" male plant. The results were absolutely identical, i.e., all tall hybrid plants were produced in the first generation.

Next Mendel allowed the tall hybrids to reproduce in the normal way, by self-pollination, and harvested the seeds that were to produce the second generation crop of sweet peas. After these seeds were planted, he discovered that the tall hybrids produced not only tall plants but short ones as well, there being three times as many tall (*dominant character*) plants as short (*recessive character*) plants. Each of the seven paired characters that he tested behaved in the same way. In the second generation, in each case, the dominant character was represented three times more frequently than the recessive. Mendel continued his history-making experiments. The seeds of each plant were harvested separately. Those sown from all the dwarf plants of the last generation retained their recessive dwarf character, i.e., they bred true. However, when the seeds of the tall plants were sown only one-third of them bred true to type. The remaining two-thirds yielded both tall and short offspring, the proportion of the tall to short again being three to one and showing exactly the same ratio as their immediate parents.

Mendel began to summarize and evaluate his results. He found that when he crossed the original true-breeding short plants with true-breeding tall plants,



**DIHYBRID CROSS**

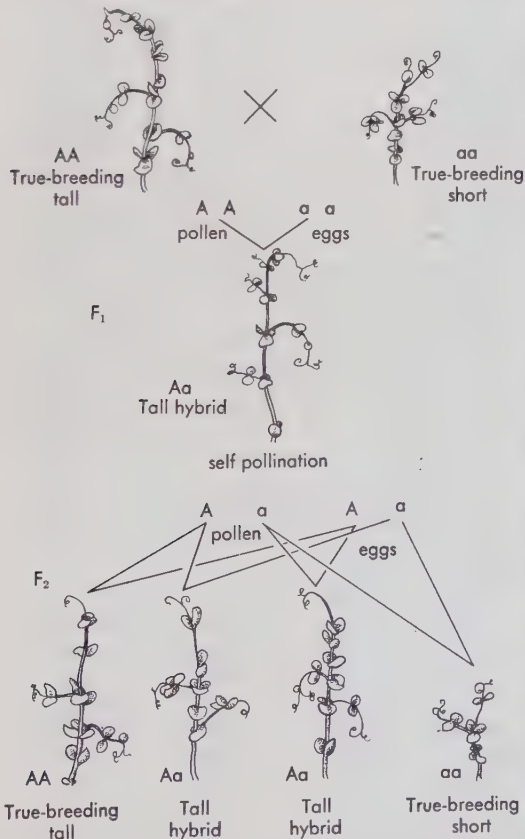
Diagram shows possible combinations arising in second generation (F<sub>2</sub>) when guinea pigs differing in two pairs of characters are mated. Rough coat (R) is dominant over smooth coat (r); pigmented coat (B) is dominant over albino (b).



he obtained all tall hybrids in the first generation. The tall hybrids, after self-pollination, produced seeds which yielded a second generation consisting of one short plant to every three tall plants. On the basis of 100 second generation sweet peas from tall hybrids, Mendel found that 25 were short plants and these when tested bred true; 25 were tall plants that also bred true; and 50 were tall plants which when tested produced tall and short plants. Thus Mendel showed that the apparent 3 tall to 1 short ratio in the second generation plants was actually: 1 true-breeding tall to 2 nontrue breeding tall to 1 true-breeding short.

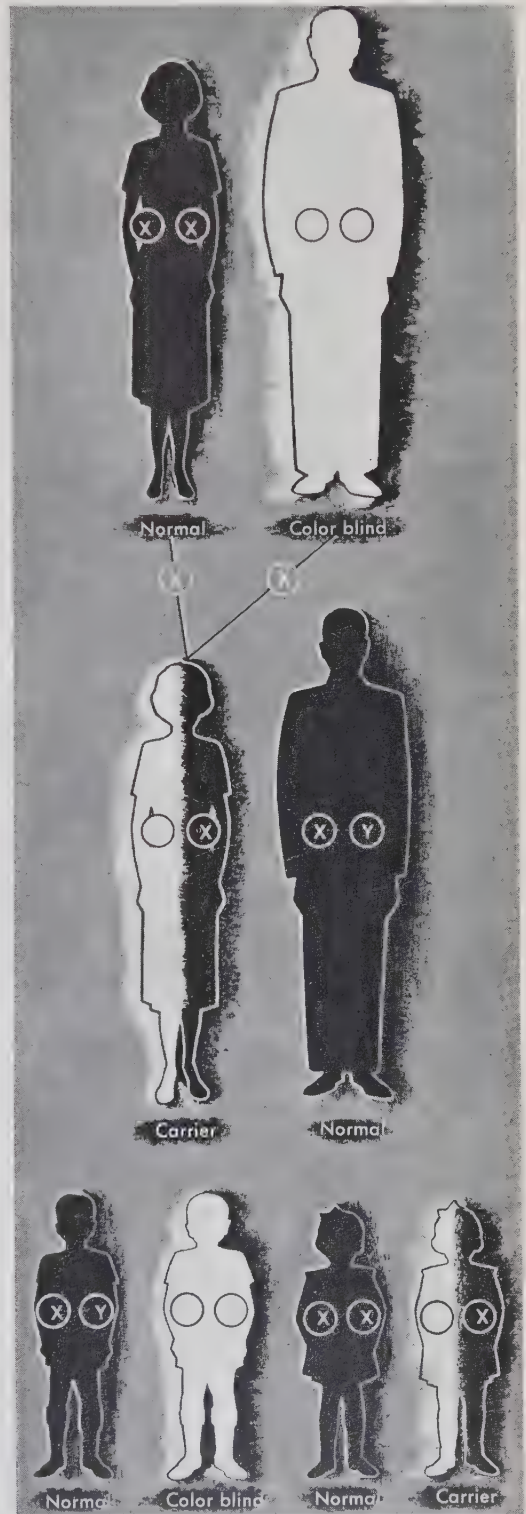
**Mendelian Principles of Inheritance.** Mendel's claim to scientific fame did not rest entirely upon his invention of the proper method of conducting experiments in heredity for he went on to identify the units of heredity. He thought of his plants in terms of their pollen and eggs. The true-breeding tall sweet pea produced pollen containing the tall hereditary factor, which he called  $A$ , and eggs containing the same factor,  $A$ . When self-pollination took place the  $A$  factor of the pollen united with the  $A$  factor of the egg, with the result that  $AA$  (true-breeding tall) plants developed. Mendel looked upon the plants as dual entities, receiving half their inheritance from their father and half from their mother. That is why he used the formula of  $AA$  rather than  $A$  to represent the pure-breeding tall plant. By a similar line of reasoning Mendel considered the short sweet peas to be composed of two uniform hereditary elements which he called  $aa$  (small letters for recessive characters in contrast to capitals used for dominant characters).

When Mendel crossed the tall plant  $AA$  with the short  $aa$  and obtained all tall plants in the first generation, he again visualized the process in terms of

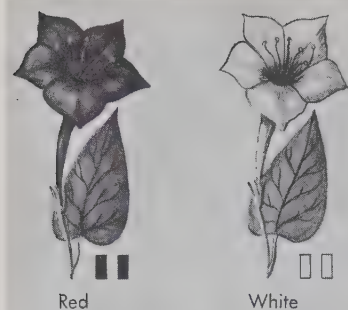


**Mendel's Experiment**, showing the principles of dominance, segregation, and independent assortment

pollen and eggs and the hereditary factors which they carried. For example, when the tall plant furnished the pollen and the short plant the egg, Mendel suggested that the pollen parent contributed the  $A$

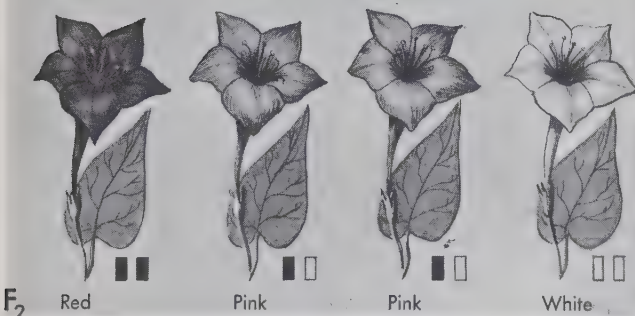
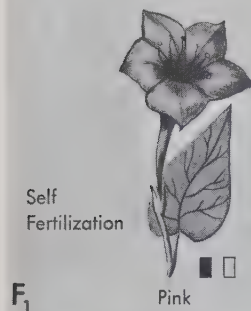


**Inheritance of Color Blindness:**  
A Sex-Linked Character



## INCOMPLETE DOMINANCE

In the heredity of some organisms, dominance of a particular character may be only partial. Red-flowered four-o'clocks crossed with white-flowered four-o'clocks yield pink-flowered plants in the first generation ( $F_1$ ). That the genes (indicated at right of each flower) do not mix is seen when  $F_1$  plants are self-fertilized, producing in the second generation ( $F_2$ ) one fourth red-, one fourth white-, and two fourths pink-flowered plants.



factors and the egg parent,  $a$ . Thus, when pollen carrying  $A$  united with an egg carrying  $a$ , the result was an  $Aa$  hybrid. Since the hybrid plant was tall, Mendel called the  $A$  factor dominant over the  $a$  factor. In appearance the original  $AA$  tall plant was not distinguishable from the hybrid  $Aa$  plant. Mendel also found that when the short plant was the pollen parent,  $a$ , and the tall plant the egg parent,  $A$ , the hybrids were tall  $Aa$ , and looked and behaved like the other  $Aa$  hybrid plants.

Upon crossing the  $Aa$  tall hybrids of the first generation with each other ( $Aa \times Aa$ ) he obtained three tall plants to every short plant in the second generation. Again he explained these results in terms of the hereditary factors carried by the pollen and eggs. As a dual entity, the tall hybrid,  $Aa$ , could produce pollen, some carrying the dominant  $A$  factor and others the recessive  $a$  factor, and could produce eggs, some carrying the dominant  $A$  factor and others the recessive  $a$  factor. Thus when thousands of dustlike pollen grains fell upon the many eggs it was entirely up to chance which kind of pollen,  $A$  or  $a$ , would fall on egg  $A$  or egg  $a$ . This means that pollen  $A$  unites as frequently with egg  $A$  as with egg  $a$ . In the first case an  $AA$  plant results, and in the second an  $Aa$  plant results. Similarly, pollen  $a$  will unite as frequently with eggs of the  $A$  type as with those of the  $a$  type. In the first case an  $Aa$  plant results and in the second an  $aa$  plant results. Adding all the four possible combinations the following plants are obtained from the  $Aa \times Aa$  mating: one combination of  $AA$ , two of

$Aa$ , and one of  $aa$ . The last represents the short plant; the others are tall, but of the tall plants only one is pure  $AA$ , while two are like their parents, hence the three to one ratio in the second generation of sweet peas.

Mendel sought to prove his theory by planting the second generation sweet pea plants, both tall and short. If this theory were correct, he could expect the short plants, which he assumed to be  $aa$ , to breed true to type since only pollen of type  $a$  and eggs of type  $a$  could be produced. In this experiment his theory was entirely correct. In testing the tall plants of the second generation, Mendel expected that one-third of the tall plants would breed true, while two-thirds would not breed true. In order to be absolutely sure, he planted the seeds of each tall plant separately so that he could record all the offspring of each plant. He found that one-third of all the tall plants tested actually did produce tall plants only, and he ascribed this to the fact that the parents must have been of the  $AA$  type. Two-thirds of the second generation tall plants did not breed true but produced three tall plants to every short one, and this behavior Mendel ascribed to the fact that the parents must have been of the  $Aa$  type.

Some of the terms which Mendel coined are still used. He called tallness a *dominant* trait and shortness a *recessive* one. He suggested that these traits were represented in the reproductive cells by *hereditary factors*. While the term factor is sometimes used today, the word *gene* is used more often. When the hereditary factors or genes are alike in a given individual, such as the tall plant,  $AA$ , Mendel simply called the individual *pure* but the term *homozygous*, meaning similar zygotes, has now replaced it. Mendel called the offspring of  $AA$  and  $aa$ , i.e.,  $Aa$ , the *HYBRID* type; this individual is now also referred to as *heterozygous* or the unlike zygote form. The pure recessive,  $aa$ , is spoken of as the *homozygous recessive*.

In addition to these important concepts in the study of heredity probably of most significance was Mendel's suggestion that the hereditary factors, or GENES, both dominants and recessives, do not lose their identity during their association in the same cell but remain as separate units generation after generation. Characters, such as tallness or shortness, are not inherited as such; only the factor for tallness or shortness is transmitted from parent to offspring. Innumerable experiments by other investigators, subsequent to Mendel, with many different plants and animals indicated that the genes contributed to hybrids by their parents do not mix but are segregated into the different sex cells of the hybrids, so that they appear unmodified by their passage through the hybrid. This is known as Mendel's *principle of segregation*. When Mendel bred double hybrids and obtained all possible combinations in the offspring, he concluded that each character was inherited independently. This has been termed the *principle of independent assortment*. Both of these Mendelian principles are of the utmost importance in the study of heredity.

**Chromosomes.** In man the number of chromosomes, determined from microscopic study of actively growing cells, has been found to be 48. Every cell in the body has this number, skin cells, liver cells, brain cells, muscle, and so on. There is but one exception, one type of cell which does not contain 48 chromo-



somes; these cells are the reproductive, or germ cells, the mature sperms produced by the male and the ripened ova produced by the female. These GERM CELLS have half the usual number, 24, and a moment's thought will provide the explanation why this is so. When the sperm with its 24 chromosomes penetrates and fertilizes the egg cell with its 24 chromosomes, the new zygote contains 48 chromosomes or 24 pairs. Thus the newly conceived individual has the number typical of its parent and retains this number for the rest of its life. The process by which the reproductive cell divides and in dividing receives only half the number of 48 chromosomes is known as *meiosis*, while the method by which the ordinary body cell multiplies for purposes of growth but at the same time maintains the same number of 48 chromosomes is known as *mitosis*.

Many plants and animals share the chromosome number of man. The violet and the lily, a snail and an ant all have 48 chromosomes, as does the Mexican platyfish. A crayfish has many, 200, whereas the parasitic roundworm, *Ascaris*, has but four. Some groups of plants have a common multiple. For instance, some species of roses have 14 chromosomes, others 28, still others have 42 and 56. Some botanists suggest that in the evolution of such groups new species originated through the duplication of the number of chromosomes during various stages of the reproductive process, particularly during the meiotic period in the production of ova and pollen. These duplications of whole sets of chromosomes may sometimes be induced artificially by chemical means, particularly by the application of the drug, *colchicine*. Changes in the original number of chromosomes may also be brought about by the use of x-rays applied at critical periods of germ cell production. The doubling of the original number of chromosomes has been termed *diploidy*; tripling is referred to as *triploidy*; quadrupling the basic number of chromosomes is *tetraploidy*. Most of these duplications are found in plants and are extremely rare in animals.

Genes are the essential units within the chromosomes, and modern genetic studies, coupled with cytological studies of the cells and their chromosomes, have revealed that genes have a definite location on particular chromosomes. For instance, cytogeneticists say that the gene for white eye color in the fruit fly, *Drosophila*, that normally has red eyes, is carried at one end of the first chromosome (also known as the sex chromosome); the gene for black coloring in the fly's otherwise gray body is carried near the middle of the second chromosome; the gene for curly wings, as opposed to straight wings, is carried near the middle of the third chromosome, while the gene for eyelessness is carried on the fourth and smallest of the chromosomes.

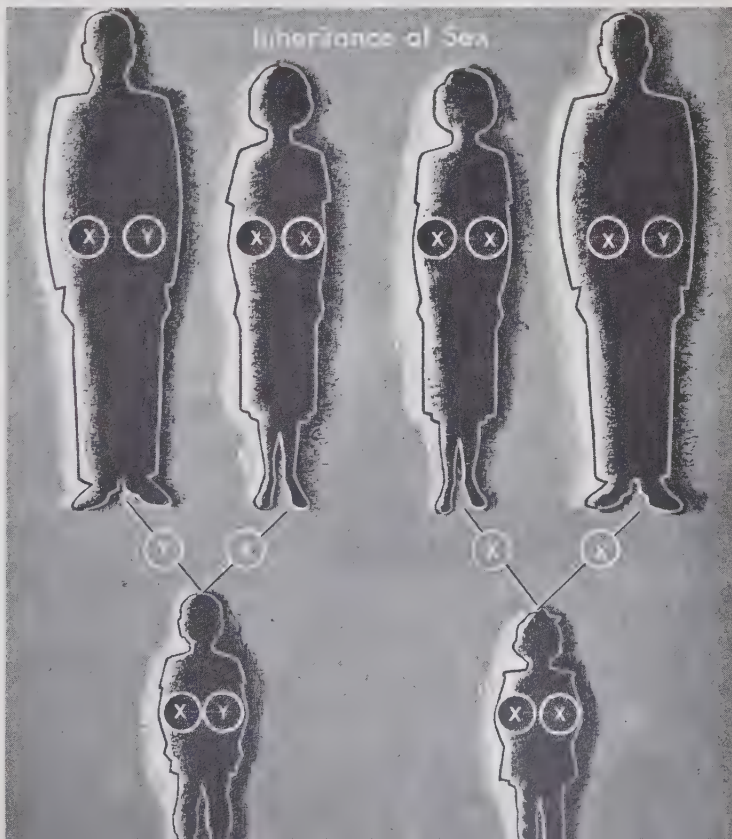
Genes are not distributed equally throughout the chromosomes. Some areas are genetically inert. This may be represented as follows, where the letters refer to genes and the dots to inert chromosomal regions: abc.....defGHijk...lm.....nop.....Qrstuvv.....xyz. These differential regions of the chromosomes are determined in some measure by the staining reaction of various parts when chemical dyes

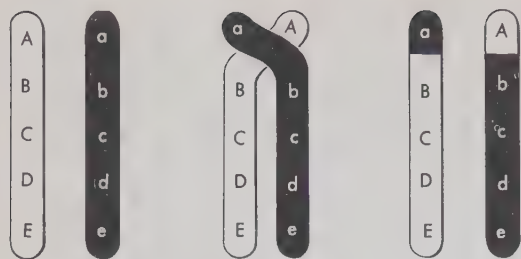
are applied. The chromosome, then, may be regarded as a linear array of units, perhaps the genes themselves, the smallest elements being a few tenths of a millimicron,  $1/25,000,000$  inch, or  $10^{-6}$  millimeters. Estimates as to exact gene size have been made. One estimate of the size of a gene is  $100 \times 20 \times 20$  millimicrons, and this may be compared with the size of the particle of the tobacco mosaic virus, which is  $430 \times 12.3 \times 12.3$  millimicrons.

**Linkage and Crossing Over.** Hundreds of genes may be carried in a single chromosome. All of them are inherited since they are associated or linked together on the same chromosome. Occasionally this intimate *linkage* is broken. For instance, when a fly with a black body, *bb*, short or vestigial wings, *vv*, and purple eyes, *pp*, is mated with a normal gray fly, *BB*, with normal wings, *VV*, and normal red eyes, *PP*, the offspring will be like the wild parent with normal body color *Bb*, normal wings *Vv* and normal red eyes *Pp*. If, then, these are inbred brother to sister, about three times as many normal flies will appear as those with the recessive characters, i.e., black bodies, vestigial wings, and purple eye color. There are likely to be some exceptional character combinations. For instance, among the offspring some might have two of the dominant features with a single recessive, such as *BVp*, or *BuP*, or *bVP*. Some of the exceptions may have two recessives and one dominant like *buP*, *bVp*, or *Bup*. These exceptions are the result of a chromosomal phenomenon, commonly known as *crossing over*. This phenomenon involves a temporary breakage and a subsequent refusing of homologous chromosomes during meiosis.

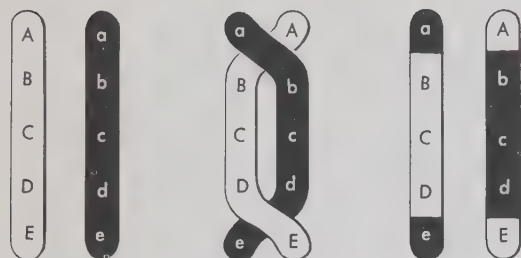
#### Inheritance of Sex and Sex-linked Characters.

In recent years it has been found that maleness in contrast to femaleness in many animals and plants behaves in a manner similar to the traits that Mendel studied. The explanation rests upon experimental evidence from matings and from a knowledge of the chromosomal constitution of the organism in question. SEX in man provides an excellent example. The cells of every man and woman each have 48 chromosomes or 24 pairs. Of these 23 pairs are identical; it is the





Single crossover



Double crossover

## CROSSING OVER

The bars represent chromosomes—  
the letters are genes

24th pair that makes the difference. In man one of the 24th pair is small, while its partner is larger. In woman both members of the 24th pair are of the larger type and are equivalent to the larger chromosome of the male. To identify the larger and smaller chromosomes quickly, the larger is called X and the smaller is known as Y. Man's genetic formula is then XY and woman's is XX, with respect to the 24th pair or sex chromosomes.

When the reproductive cells are formed in man, each sperm has 24 chromosomes: either 23 plus X or 23 plus Y. When they are formed in woman, each ovum has 24 chromosomes, all of which will have 23 plus X. Now if a sperm with 23 plus X should enter and fertilize an ovum with 23 plus X, the new zygote or individual will have 46 plus 2 X chromosomes and will be a female child. If a sperm with 23 plus Y chromosomes fertilizes an ovum with 23 plus X chromosomes, the new individual will have 46 plus X and Y chromosomes and will be a male. Since there are produced approximately as many sperms carrying X as carrying Y, the genetic ratio is one to one. At every conception there is a 50 to 50 per cent chance expectancy with respect to the production of a boy or girl child.

In addition to the genes that control sex determination, the sex chromosomes, especially the X chromosomes, contain many genes for other characters, known as *sex-linked* characters. Among these may be mentioned the recessive genes for human color blindness and hemophilia, both of which when present are carried on the X chromosome. A color-blind man, for example, will transmit through the X chromosome the gene for color blindness to all of his daughters by a normal woman. These daughters, however, will appear normal because the corresponding normal gene in the other X chromosome dominates the recessive color-blind gene. If any of the daughters have children by a normal man, theoretically half of their sons will be color-blind, and half of their daughters, though appearing normal, will carry the gene for color blindness.

**Inheritance of Diseases.** Although the majority of human diseases are due to environmental influences, certain diseases and defects are known to be

hereditary. Many of these are attributable to recessive genes and show up in the individual only when two recessive genes for the defect are present. Among these may be mentioned dwarfism, albinism, infantile amaurotic idiocy, feeble-mindedness, and multiple sclerosis (hardening of the brain and spinal cord). A few abnormalities, however, such as diabetes mellitus, polydactylism (extra fingers and toes), brachydactylism (short fingers and toes), Huntington's chorea, and certain kinds of night blindness, are due to dominant genes. Others, chief among which are color blindness, hemophilia, and nearsightedness, are sex-linked in inheritance.

**Mutations.** A *mutation* is the origin of a hereditary character which previously was not represented by a gene in the germ cells of the parents of the new individual, the *mutant*. Mutations are of primary importance in the study of **EVOLUTION** for to some extent they account for the origin of species. The frequency of their natural occurrence varies with the species and the conditions to which the species is subjected. It has also been found that mutations occur more frequently in certain locations on the chromosome. A mutation arises rarely in man. For instance, it has been estimated that about one sex cell in every 100,000 human beings is changed in such a way that it carries a newly formed mutant gene for *hemophilia*, bleeder's disease. Other mutants arise at different rates, but their frequency is low. Dominant mutants are more easily traced than recessive ones. Should a recessive mutant arise, it would be hidden in the individual first carrying it. The mutated gene in future generations would spread through the populations and the character it represents would appear only when two sex cells each carrying the recessive gene unite. A person with such a new mutant may represent a hereditary change not in his immediate parent but in some ancestor far back. Unless a family line is outstanding in history, human mutants are extremely difficult to follow. Apparently the British Queen Victoria arose from a mutant sex cell, a change that effected a gene for hemophilia in the sex chromosome. This trait has been traced through the royal families of Russia and Spain, some of whom were the lineal descendants of Queen Victoria.

**Research on the Nature of the Gene.** Our knowledge of the nature of the gene can be stated at present only in the most approximate terms. The subject is being actively studied by geneticists, cytologists, and the cytochemists, who have approached it in rather indirect ways. Since chromosomes are so intimately associated with genes, study of the chemical and physical structure of chromosomes is being conducted. It is believed that the solution of the problem may be furthered by close study of the developmental effects of associated genes such as those within an allelic series, where more than two phases of gene reside at the same point of the chromosome. Studies of the differential effects of the same genes but in slightly different positions on the chromosomes are given special attention; so is the general problem of the nature of mutations and how mutations may be induced by x-rays and other physical forces. Recently chemical effects, such as the treatment of organisms with the mustards, synthesized in the war chemical division of the army, have proved capable of modifying gene patterns. The electronic microscope and the nuclear matter of yeasts and other primitive forms of life, including viruses, are being employed by geneticists to gain some knowledge of the nature of the gene. See **EUGENICS**.

MYRON GORDON

**BIBLIOG.**—E. W. Sinnott and L. C. Dunn, *Principles of Genetics* (1939); A. Scheinfeld and M. D. Schweitzer, *You and Heredity* (1939); E. C. Colin, *Elements of Genetics* (1941); Th. Dobzhansky, *Genetics and the Origin of Species* (1941); E. Altenburg, *Genetics* (1945); L. C. Dunn and Th. Dobzhansky, *Heredity, Race, and Society* (1946); R. R. Gates, *Human Genetics* (1946).

**Psychological Aspect.** The facts of heredity, insofar as they are established by experiment, cannot be



denied. But, if heredity gave the ultimate answer to the question of human variability, psychology would have no reason for being. There is a division of labor between psychology and biology which permits the two sciences to supplement each other. This is based on the assumption that biology deals with the structure of organisms, while psychology deals with their behavior. Biologists have been studying genes and chromosomes, and only indirectly making assumptions about behavior, while psychologists have been studying behavior, and indirectly drawing conclusions about heredity. It is generally agreed, however, that structure is inherited. But behavior cannot be inherited, *except* as it depends on structure which is inherited. This is the modern approach to the question as to whether heredity or ENVIRONMENT is more important. See CONSTITUTIONAL TYPES; PERSONALITY AND ITS MEASUREMENT; PERSONALITY DEVELOPMENT; NATURAL SELECTION; GALTON, FRANCIS. M. H. KROUT

**HEREFORD**, municipal borough and county town, England, in Herefordshire, on the Wye River; 31 miles NW of Gloucester. It has been the seat of a bishop since 672. A notable feature is St. Ethelbert's Cathedral (1079-1148), representing varieties of architectural style from Norman to Perpendicular and containing many interesting tombs and a chained library with rare manuscripts and relics. Other points of interest include the Old House, a picturesque example of a half-timbered dwelling of 1620; the Black Cross Hospital, built on the site of a Black Friars' priory; and the ruins of an ancient castle erected by Harold II, king of the Saxons, prior to the Conquest. Industries include a munitions factory, tanneries, and a tile factory. There is trade in leather and cider. Hereford is the birthplace of David Garrick and Nell Gwynn. It was raided by German flyers several times during the early part of World War II but suffered little damage. Pop. (1951) 32,490.

**HEREFORD CATTLE.** See CATTLE.

**HEREFORDSHIRE**, inland and border county SW England, in the W Midlands, bounded on the N by Shropshire, E by Worcester, S by Gloucester and Monmouth, W by Brecknock and Radnor (Wales); area 843 sq. mi.; pop. (1950) 127,000. On the southwest border are the Black Mountains, which rise to 2,000 feet; on the east is the Malvern range, of which the Hereford Beacon (1,195 ft.) is the highest point. The principal rivers of the shire are the Wye, with its tributaries the Luff, Arrow, and Monnow, and the Teme and the Frome. The county is well-wooded, pastoral, and generally agricultural. Hops and grains are the chief crops, and there are vast areas in apple and pear orchards and berry thickets. Horses, sheep, and cattle are grazed. The white-faced Hereford cattle are the favorite breed raised (see CATTLE). The leading industries, in addition to farming and stock-raising, are iron founding, limestone quarrying, and the manufacture of farming implements, paper, and cider. Cider, hops, and fruits are exported. The most important towns of the county are **HEREFORD**, the county seat, Ross, Kingstone, LEOMINSTER, and Ledbury. The county was once a part of the kingdom of Mercia. Among ancient remains are a cromlech called Arthur's Stone, traces of Offa's Dyke, and Watling Street. K. E. H.

**HEREROS**, a section of the Bantu people in Damaraland. In 1904-6 the Hereros were in open revolt against the Germans. See SOUTH-WEST AFRICA.

**HERESY**, a term applied to views or doctrines at variance with prevailing or standard beliefs, but generally restricted to the sphere of theology. The word occurs several times in the New Testament (I Cor. 11:19; Gal. 5:20; II Pet. 2:1), but only in the last instance does its meaning correspond to its present usage. It is to be noted that the New Testament condemns false teaching on the ground of its moral concomitants or results rather than as intellectual error pure and simple; it was left for a later time to deny salvation to all who did not accept the

church's doctrines in their entirety. From the first the orthodox and dominant party dealt severely with heretical teachers; after adequate warning and ex-postulation it put them under the ban of excommunication (cf. Titus 3:10); but when it came to wield the arm of civil power, it could, and usually did, visit the offenders with corporal penalties as well. Thus, A.D. 385 Priscillian, bishop of Avila, was put to death as a Manichean. Many heretics have suffered execution and torture, particularly at the hands of the INQUISITION. The Roman Catholic Church today distinguishes between *formal* heresy, which is deliberate denial of the truth revealed by the church, and *material* heresy, which is the result of ignorance of the revealed truth. EXCOMMUNICATION, by the pope, may be imposed for formal heresy, but material heresy is considered blameless. See GNOSTICISM; INQUISITION; MANICHEISM; WYCLIFFE, JOHN; HUSS, JOHN; CALVIN, JOHN.

BIBLIOG.—H. Belloc, *Great Heresies* (1938); G. G. Coulton, *Inquisition and Liberty* (1938).

**HEREWARD THE WAKE**, fl. 11th century, English patriot, was born near Bourne in Lincolnshire. After the Norman Conquest he retreated to the marshy fens of the Isle of Ely, where for a year he held out against William the Conqueror. Being finally driven out, Hereward escaped, but his subsequent fate is not certain. His career is depicted in Charles Kingsley's *Hereward the Wake*. See WILLIAM I.

**HERFORD, OLIVER**, 1863-1935, American writer and illustrator, was born in England. He was educated at Lancaster College, England, and Antioch College, Ohio, and later studied art at the Académie Julien in Paris. Besides illustrating the works of other authors, he wrote and designed his own books of light whimsy. Among them are *The Bashful Earthquake* (1898), *Cymic's Calendar* (1917), and *The Deb's Dictionary* (1931).

**HERFORD**, town, Germany, in the Prussian province of Westphalia, at the confluence of the Werre and the Aa rivers, nine miles NE of Bielefeld. Founded in the ninth century, Herford was the seat of a Benedictine nunnery (819-1802), whose abbess ranked as a peer of the empire. The town's chief manufactures include linen and cotton goods and machinery. Herford surrendered to the Americans on Apr. 6, 1945, and later was incorporated in the British occupation zone, where for a time it was an administrative center. Pop. (1946) 43,880.

**HERGESHEIMER, JOSEPH**, 1880-1954, American novelist, was born in Philadelphia, Pa. He was educated at a Quaker school and at the Pennsylvania Academy of Fine Arts. His novels are mainly concerned with historical and regional subjects, and include: *The Lay Anthony* (1914); *Java Head* (1919); *Balisand* (1924); *The Limestone Tree* (1931); *The Foolscap Rose* (1934).

**HERGEST, RED BOOK OF**, ancient manuscript of Welsh literature, dating from the 13th and 14th centuries. It takes its name from Hergest Court, a seat of the Vaughan family, where tradition asserts it was written. It contains, in addition to a mass of other material, 11 tales in Welsh, the latter collection being termed MABINOGION. The stories chiefly relate to the deeds of the legendary King ARTHUR and the mythical early British kings.

**HERI RUD.** See HARI RIVER.

**HERISAU**, town, NE Switzerland, the largest town in the canton of Appenzell, seven miles SW of St. Gallen. It is the center of the muslin and cotton embroideries industry in Switzerland. Pop. (1941) 12,789.

**HERISTAL.** See HERSTAL.

**HERKIMER, NICHOLAS**, c. 1715-77, American soldier in the Revolutionary War, was born in New York, probably in what is now Herkimer County. He was in command at Fort Herkimer (at present in German Flats, N.Y.) in 1758, in 1775 was colonel of the Tyrone County militia, and was made a brigadier general of the N.Y. militia in 1776. His

expedition for the relief of Fort Stanwix (1777), then besieged by St. Leger, was ambushed by Indians at ORISKANY and badly cut up, but St. Leger was obliged to raise the siege. In this fight, a most bloody and savage one, Herkimer had his leg broken by a musket bullet, but he contrived to direct the battle. A few days afterward he died from the effects of an unskillfully performed amputation.

**HERKIMER**, village, central New York, county seat of Herkimer County, on the Mohawk River, the New York Barge Canal System, and the New York Central Railroad, 14 miles SE of Utica. Herkimer, an industrial center and a shipping point for dairy products, is situated in the picturesque Mohawk Valley. It was settled by German immigrants about 1725 and later named for Gen. NICHOLAS HERKIMER. The principal industries are the manufacture of desks and other office furniture, paper products, hardware specialties, gloves, and sportswear. Pop. (1950) 9,400.

**HERKOMER, Sir HUBERT VON**, 1849–1914, English painter, etcher, and engraver, was born in Waal, Bavaria. The Herkomer family migrated to America, then settled in England when Hubert Herkomer was six. After studying art in Munich and London, he exhibited such pictures as "After the Toil of the Day" (1873) in the Royal Academy and was elected a member of the Academy in 1890. In 1883 Herkomer founded the Herkomer School of Art which had an important effect on English art education.

**HERMANDAD, or HOLY BROTHERHOOD**, an association of towns in Aragon, Castile, and León, formed about the middle of the 13th century for their mutual protection against the nobles. It was reorganized in 1295, and still further extended in 1486 (in Castile) and 1488 (in Aragon). As the absolutist power of the sovereigns grew the power of the Hermandad declined, and by the middle of the 16th century it became extinct. The name was transferred to a body of military police in the pay of the council of Castile. One of their principal duties was to ensure the safety of highways.

**HERMANNSTADT**. See SIBIU.

**HERMANRIC, or ERMANARIC**, fl. fourth century, king of the East Goths, founder of their kingdom toward the middle of the fourth century. See GOTHs.

**HERMAPHRODITE**, an individual in which both male and female reproductive organs are present. A hermaphroditic, or monocious, condition is often found among plants, where male and female flowers may occur on the same plant but distinct from one another (as in SQUASH, CORN, and BIRCH). Among parasitic and invertebrate animals, hermaphroditism is a common occurrence. In the primitive hagfish, *Myxine*, the unpaired gonad first produces sperm and later eggs. Hermaphroditic animals usually cross-fertilize one another; see EARTHWORM. Self-fertilization occurs in a few animals, e.g., the TAPEWORM.

In the higher vertebrates an hermaphroditic condition is never normal, but it does occur in rare instances as a result of genetic aberration. The condition is extremely rare in man, and only slightly more common in pigs. Hormonally unbalanced human beings with some physical characteristics of the opposite sex, and homosexuals, are sometimes mistakenly termed hermaphrodites. See GYNANDROMORPH; HOMOSEXUALITY; SEX, *Role of Sex Hormones*.

W. J. HAMILTON, JR.

**HERMAPHRODITUS**, son of Hermes and Aphrodite, who became united with the nymph of the fountain of Salmacis, near Halicarnassus, the two forming one person with characteristics of both sexes.

**HERMAS, SHEPHERD OF**, a quasi-apocalyptic work written by an apostolic father of the early Christian church whose name was Hermas or Hermes. The writing was held in great esteem in the ancient church, and is a valuable source of information regarding the condition of the Roman community in the second century. Irenaeus quotes it as Scripture; Origen considered it divinely inspired; the Mura-

torian Canon assigns it to a brother of Bishop Pius of Rome (c. 150), which serves to indicate the approximate date of its composition. Part of the original Greek is found in the Codex Sinaiticus, discovered by Tischendorf in 1859, until which year the *Shepherd* was known only in a Latin translation. Subsequent discoveries in 1863 and 1888 have afforded a complete Greek text. Because of numerous corruptions in the church, the author urges all to repent. The utterances of repentance are made by an angel disguised as a shepherd.

BIBLIOG.—C. Bonner, ed., *Papyrus Codex of the Shepherd of Hermas with a Fragment of the Mandates* (1939).

**HERMES**, called *Mercurius* by the Romans, one of the Greek gods, was the son of Zeus, and was born in a cave in Mount Cyllene in Arcadia. According to the legends, he had only been born a few hours when he stole the cattle of Apollo, which he drove from Pieria to Pylos. When Hermes grew up, Zeus made him the herald and messenger of the gods; it was also his duty to guide the souls of the dead to the lower world. As the herald of the gods, he was the patron deity of eloquence; as the god of prudence and cunning, he was worshiped by merchants and traders; and his reputation for ingenuity caused him to be regarded as the author of the lyre, the alphabet, numbers, gymnastics, weights and measures, etc. He was also worshiped as the patron of roads and travelers; hence the statues called *Hermæ* were set up to him on roads and at the entrances of buildings. He was also the god of luck. He was especially the patron of gymnastics; and he himself was represented in art as a youth whose figure showed the ideal perfection of graceful and harmonious development of the body, as in the famous statue of him by Praxiteles at Olympia. His regular attributes are a broad-brimmed cap, the herald's staff or CADUCEUS, and the winged sandals which bore him on his journeys. The Homeric *Hymn to Hermes* gives the best account of his birth and childhood.

**HERMES TRISMEGISTUS**. See THOTH; HERMETIC BOOKS.

**HERMETIC BOOKS**, a sort of encyclopedia of ancient Egyptian lore, of which fragments only survive, unless the whole or part of one of its divisions is to be recognized in the *Papyrus Ebers*. The portions that survive exhibit undeniable traces of the influence of late Greek or rather Alexandrine philosophy. The name is derived from Hermes Trismegistus, the Greek designation of Thoth, the Egyptian god of intelligence; though later the Neoplatonists and some Christian writers regarded Hermes Trismegistus as an ancient sage, to whom they attributed the fragments. As the lore contained in these books was traditionally believed to have been mastered and guarded with jealous care by a comparatively small number of experts, the term "hermetic" came to be almost synonymous with esoteric—i.e., something reserved to the initiated only.

BIBLIOG.—W. Scott, ed., *Hermetica* (1936).

**HERMIONE**, in Greek mythology, the daughter of Menelaus and Helen of Troy. She was engaged to marry Orestes, but after Menelaus returned from the Trojan War he married his daughter to Neoptolemus, who had slain Priam and played an important part in the capture of Troy. Orestes murdered Neoptolemus and married Hermione, by whom he became the father of Tisamenus, later king of Argos.

**HERMIT**, one who retires from society in order to live a solitary life of meditation and devotion. It was perhaps natural that Christianity, with its demand of crucifixion of the world (cf. Gal. 6:14), should be understood by some as enjoining the abandonment of the ordinary secular life; and the early centuries witnessed a remarkable development of the practice, more or less helped by persecution. Thus, during the persecution under Decius, Paul of Thebes took up his residence in the Egyptian desert, though his story, as given by Jerome, is regarded as being



largely romantic. The real father of Egyptian anchoritism is St. ANTHONY, whose privations and conflicts brought him great veneration. He was, though unlearned, a truly pious man; but his example was followed by many out of sheer pride. Occasionally strange and fanciful forms of separation were adopted—e.g., by the Stylitae, the most famous of whom was one Simeon, who lived for years on the top of a pillar; and the Bosci, or Grazers, who lived on herbs. As Christianity spread to the west and north, the rigors of climate tended to prevent the transportation of hermitism, and its place was largely taken by monasticism. See SIMEON STYLITES, SAINT.

**HERMIT CRAB**, a decapod crustacean of the family *Paguridae*, characterized by its habit of appropriating empty gastropod shells, in which it lives, in order to protect its soft and vulnerable abdomen. Colonies of a hydroid, *Hydractinia echinata*, are sometimes found on the shells and enlarge them by building up the free edges. As a result, the growing hermit crab may be spared the task of changing shells.

**HERMIT THRUSH**, one of the most beautiful of American thrushes, distinguished by the pure brown of its upper parts, the wedge-shaped spots on its buff breast, and its reddish tail.

**HERMITAGE**, a dry, red wine of the Rhône Valley, resembling burgundy in body and color.

**HERMITAGE, THE**, home of ANDREW JACKSON, seventh president of the United States, near Nashville, Tenn. In a group of log houses built in 1804 and known as The Hermitage, Jackson, then an ex-member of both houses of Congress, entertained many important people including Aaron Burr. In the present two-story brick structure on the same site, erected in 1818 and also known as The Hermitage, many famous guests, including President Monroe in 1819, and Lafayette in 1825, enjoyed the hospitality of General Jackson, then the nation's idol after the Battle of New Orleans. The Hermitage also served as political headquarters throughout the campaigns preceding Jackson's nonelection, election, and re-election to the presidency in 1824, 1828, and 1832. Near this house, in a large flower garden, Jackson was buried beside his wife in 1845.

Retaining all the flavor of the antebellum architecture and typical of the Tennessee planter's home, The Hermitage has one-story wings on both sides and tall white columns supporting double verandas at the front and rear. There are 11 large, high-ceilinged rooms in addition to the kitchen, pantry, storeroom, and cellar.

**HERMON, MOUNT**, a triple snow-clad mountain peak (alt. 9,232 ft.), forming the S extremity of the Anti-Lebanon range on the border between Lebanon and SW Syria. It is encircled with ruins of ancient temples dedicated to Baal worship, and is referred to in Hebrew poetry. See LEBANON MOUNTAINS.

**HERMOSA BEACH**, city, S California; Los Angeles County, on the Santa Fe Railroad, 20 miles SW of Los Angeles. It is a pleasant seaside residential city. Pop. (1950) 11,826.

**HERMOSILLO**, city, Mexico, capital of Sonora State, on the Sonora River; 85 miles N of Guaymas. It is located in the center of a rich fruit-growing district producing oranges, limes, dates, figs, bananas, peaches, and avocados. Mining is also important in the district. The University of Sonora is here. Pop. (1950) 53,189.

**HERMOUPOLIS**, or **Syros**, seaport and capital of the Greek nomarchy comprised of the CYCLADES ISLANDS, on the E coast of the island of SYROS, off the SE coast of Greece; 47 miles SE of ATHENS. It consists of an upper town situated on high ground and a lower town built around the crescent-shaped harbor. The town was founded during the Greek War of Independence (1821–31). It is a Greek archiepiscopal see and the center of the Levant trade. Industries include shipbuilding, flour mills, tanneries, glass and pottery works, and the manufacture of iron wares and cast-

ings, cotton goods, leather articles, rope, handkerchiefs, sashes, yarn, tobacco, and loukoumi ("Turkish Delight," a sugared jelly confection) and other sweetmeats, and preserves. It is a port of call for European liners and freighters. Pop. (1950 est.) 22,000.

**HERNÁNDEZ, GREGORIO**, c. 1576–1636, Spanish sculptor, was born in Santiago. The first specific date in his life is 1605 when he was commanded by Philip IV of Spain to set up a studio in Valladolid. Here in 1621 he produced his "Holy Family" for the Church of San Lorenzo, and the high altar for the Franciscan monastery of Eibar (1624–29). His "El Cristo de la Luz" is indicative of his preference for scenes of the Passion and also of his revolutionary naturalism. In a period which emphasized classicist mannerisms Hernández painted his statues in subdued, realistic colors, fitted them with glass eyes, and sometimes even affixed glass tears to their cheeks. Consequently the head was always the center of interest in his figures. His interpretation of form was extremely plastic, yet he stressed the flatness of the background in his bas-reliefs and often surrounded his round sculpture with a flat surface backing.

**HERNDON, WILLIAM HENRY**, 1818–91, American lawyer and biographer of ABRAHAM LINCOLN, was born in Greensburg, Ky. His family settled in Springfield, Ill. (1825), and as a youth he attended Illinois College but was withdrawn by his father for showing too much interest in the Abolition movement. In 1844 Lincoln offered him a law partnership, which lasted 16 years and, nominally, until Lincoln's death. Herndon took a leading part in the formation of the Republican party in Illinois and claimed to have persuaded Lincoln to join it. After Lincoln's death he devoted himself to collecting the biographical material on which his *Herndon's Lincoln: The True Story of a Great Life* (1899), written in collaboration with Jesse W. Weik, was based. His frank realism offended the taste of his contemporaries, but later generations have ranked the book among the greatest of Lincoln's biographies. Emanuel Hertz, in *The Hidden Lincoln* (1938), printed many of Herndon's letters and notes.

PAUL M. ANGLE

**HERNE, JAMES A.**, 1839–1901, American actor and dramatist, was born in Troy, N.Y. For the last 20 years of his life he appeared almost exclusively in his own plays. These include *Hearts of Oak* (1878); *Margaret Fleming*; *Shore Acres* (1892–93), a very popular play of rural life in New England; *Rev. Griffith Davenport* (1899), a drama of the Civil War; and *Sag Harbor* (1900). He was an excellent actor and a skillful stage manager. His impersonation of "Uncle Nat" Berry, in *Shore Acres*, was one of the distinct achievements in American comedy.

**HERNE**, city, Germany, in the Prussian province of Westphalia, on the Rhine-Herne Canal, at the junction of the Dortmund-Gelsenkirchen rail line. Located in the heart of the Ruhr coal region, Herne is the seat of a mining school. Its manufactures include machinery, ammonia, and boilers. Herne, known in the 10th century as Haranni, became a town in 1898. Pop. (1946) 68,250.

**HERNE BAY**, urban district and seaside resort, SE England, on the N coast of Kent, on the Thames estuary, eight miles NE of CANTERBURY. It has a fine pier and a six-mile esplanade. The town suffered intensely from air raids during World War II; more than 1,200 incendiary bombs fell in 1941 on the naval base and docks. Pop. (1950 est.) 17,600.

**HERNE THE HUNTER**, an old English legendary character who roamed at midnight round a famous oak in Windsor Forest, popularly supposed to have been blasted by the evil spirit of the hunter, assuming the shape of a great stag with huge horns. Shakespeare alludes to the legend in *The Merry Wives of Windsor*. Herne's Oak, supposed to be 650 years old, fell from natural decay in 1863. On the spot where it stood Queen Victoria planted a young oak.

**HERNIA** is the protrusion of an internal organ through a defect in the body wall. Hernias include the following principal classifications.

(a) **Inguinal Hernia** is a protrusion of a loop of bowel through the inguinal canal, a passage between the layers of muscles through which in the male passes the spermatic cord and in the female the round ligaments (see REPRODUCTIVE SYSTEM). Inguinal hernias are described as *direct* when they protrude through the lower ring or opening of the inguinal canal without traversing the length of this space. They are called *indirect* when they enter the inguinal canal at its inner ring or opening and protrude through it. They are most common in the male, usually descending into the scrotum.

(b) **Femoral Hernia** is a protrusion through a defect in the abdominal wall close to the inguinal canal but more laterally placed in relation to the thigh.

(c) **Ventral Hernias** occur most commonly in infancy at the site of the umbilical cord through a defect between the large longitudinal muscles of the abdomen. Ventral hernias may also occur in older people with greatly relaxed muscles, especially after rapid and extensive loss of weight.

(d) **Internal Hernias** may occur through a defect in the diaphragm or in the peritoneum, where a coil of intestine or a portion of the stomach may protrude through an opening; the much popularized "upside-down stomach" was a case of diaphragmatic hernia, not exactly common but not so rare that doctors are not universally familiar with it.

(e) **Hernias of the Brain** or its membranes, or of the spinal cord or its membranes may occur if there is a defect in the bony structure of the cranium or of the spine. Such a hernia of the spine is called a *spina bifida*; unless small these are usually fatal.

(f) **Surgical, or Postoperative, Hernias** may occur if there is imperfect healing of an operative wound, especially when there has been infection and extensive scarring.

Small hernias may go unnoticed and may be disclosed only when there is a physical examination for insurance, military service, or similar routine service. Any hernia may suddenly become an acute threat by being "strangulated." An example of strangulation is an inguinal hernia where a loop of intestine has been protruding into the scrotum. If this becomes choked off at the base by means of twisting, swelling, or other obstruction, the blood supply of the protruding loop is interfered with and there is created an immediate acute inflammatory condition which constitutes a serious crisis and a probable threat to life unless there is immediate surgical interference. Strangulation of an internal hernia may occur through similar causes.

**The Cause of Hernia** is usually a congenital structural defect although such a defect may be slight and there may be no hernia unless the condition is aggravated by injuries, particularly strains involved in lifting or other heavy muscular effort involving greatly increased muscular action and intra-abdominal pressure. Because of the abdominal relationships the inguinal canal in man is much more vulnerable to hernias than in women. Women, on the other hand, suffer more from femoral hernias, ventral hernias, and postoperative hernias.

**Treatment.** Inguinal and femoral hernias may be treated in any of the following ways: The organs may be prevented from protruding by devices known as *trusses*. A truss selected judiciously by a physician and fitted under his supervision may be an entirely satisfactory and logical treatment, especially if the patient is in too poor physical condition to withstand surgery or if the patient refuses surgery. Unfortunately there has been much exploitation of trusses. A truss is never curative. At best it is a makeshift and a nuisance. Moreover, trusses have been advertised under fanciful names which would lead the buyer to

believe that he is buying an appliance which is not a truss. Any appliance which will hold a hernia in place is a truss or a modification thereof.

The defect in the body wall may be repaired by *surgery*. This surgery consists in reconstructing the muscular layers so as to close the excessive width of a normal passage, such as the inguinal canal, or to obliterate the defect, as in the case of spina bifida and surgical hernias. Operation, when possible, is the best method for the treatment of hernia. It is best performed early, before there has been extensive local inflammation with adhesions and other factors which make operation more complicated and the reconstruction of a functioning wall more difficult. Whenever the condition of the patient is such that surgical risks are not too great, operative reconstruction is the method of choice for the treatment of hernias.

In selected instances, small inguinal and femoral hernias can be obliterated by the use of *tissue irritants* injected at the site of the hernia for the purpose of inducing inflammation with subsequent scar tissue formation and the consequent closing of the defect. This method has attained popularity among patients because it does not require hospitalization. On the other hand, it requires a number of visits to the doctor's office for injections and its applicability is limited to a small percentage of cases. The proportion of failures is about the same as in the operative method. Injections have been exploited by physicians who do nothing but injection treatments for hernia. If the injection treatment is to be used at all it should be used in carefully selected cases, by physicians experienced and competent in the operative repair of hernias as well as in the use of injections.

All internal hernias and brain hernias or spinae bifidae must be treated surgically, if operable. When a hernia has been successfully repaired by surgery there is a certain percentage of failures and recurrences, mostly in cases where the operation has been deferred too long. In approximately 90 per cent of cases, however, operative repair of a hernia gives a completely satisfactory and permanent result.

W. W. BAUER, M.D.

**HERNICI**, Sabine people who dwelt in Latium in ancient Italy. Their chief town was Anagnia. They were friends of the Romans, with whom they made a league in 486 B.C., and to whom they were loyal allies until 362, when they rebelled for four years. They remained faithful when the Latins revolted about 340, but in 306 they joined the Samnites against Rome. They were soon conquered, and lost their independence.

**HERNÖSAND.** See HARNÖSAND.

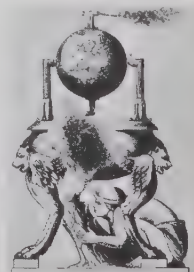
**HERO**, in Greek mythology. See LEANDER.

**HERO**, or **HERON**, OF ALEXANDRIA, lived first or second century B.C., mathematician and physicist, was probably an Egyptian, but wrote in Greek. He invented a water clock, hydraulic organ, and compressed-air catapult; studied the determination of areas, volumes, and heights; described levers, wedges, screws, pulleys, a fire engine, a self-trimming lamp, an acoliptile, and a theodolite; is credited with the invention of a rudimentary form of steam engine; and discovered the formula for the area of a triangle in terms of its sides—

$$\sqrt{s(s-a)(s-b)(s-c)},$$

where  $a$ ,  $b$ ,  $c$  are the lengths of the sides, and  $s$  the semi-perimeter.

**HEROD AGRIPPA I**, d. A.D. 44, was the son of Aristobulus, and grandson of Herod the Great. Caligula made him governor of Abilene, Batanea, Trachonitis, and Auranitis, to which Claudius added Judea and Samaria. He had the



Hero's engine



Apostle James executed and Peter imprisoned, A.D. 44. He died at Caesarea in the same year.

**HEROD AGRIPPA II**, born c. A.D. 27, son of Herod Agrippa I, took the Roman side when the Jews began war with Rome in 67, and after the capture of Jerusalem in 70, he retired to Rome, where he died. It was before Herod Agrippa II and Festus that the Apostle Paul made his defense at Caesarea.

**HEROD ANTIPAS**, son of Herod the Great, became Tetrarch of Galilee upon his father's death (4 B.C.). He married Herodias, his brother Philip's wife, and imprisoned and executed JOHN THE BAPTIST for censuring this act. He went to Rome A.D. 38 to try to obtain the title of king from Caligula, but Agrippa prejudiced the emperor's mind against him, and he was deprived of his dominion, and exiled first to Lyons and then to Spain. See JESUS CHRIST.

**HEROD THE GREAT**, c. 74-4 B.C., king of the Jews, was of an Idumean family. He obtained the government of Galilee in 47 B.C., was made governor of Coele-Syria the next year, and in 40 B.C. became king of Judea through the help of Augustus and Antony. The Jews, however, supported Antigonus, of the rival Hasmonean dynasty, and it was only after a prolonged siege that Herod made himself master of Jerusalem. He amassed great wealth by confiscating the property of his enemies, which he expended on the restoration of Samaria, the building of Caesarea, and the Temple at Jerusalem. It was in the last year of his life that he ordered the "massacre of the innocents" at Bethlehem (though this is not mentioned by Josephus).

**HERODES ATTICUS, TIBERIUS CLAUDIUS**, A.D. 104-180, Greek rhetorician. He possessed great wealth, even after presenting five minae—nearly \$100—to every Athenian citizen in fulfillment of his father's will. He built a race-course (the ruins of which remain) and a theater at Athens, a theater at Corinth, a stadium at Delphi, and hot baths at Thermopylae. He taught rhetoric in both Athens and Rome, having Marcus Aurelius and Lucius Verus, later emperors, as pupils. In 143 he was made consul by Antoninus Pius.

**HERODOTUS**, c. 485-c. 425 B.C., Greek historian, was born in Halicarnassus, Asia Minor. Tradition asserts that he played an important part in the revolution at Halicarnassus, by which the tyrant Lygdamis was expelled, but that he was himself subsequently exiled by the democracy. Certain it is that he resided for a time at Athens, and took part in the foundation of the colony of Thurii in southern Italy; and it is probable that he died at Thurii.

The main subject of his work was the war between Persia and Greece, in which he saw the final issue of a struggle that had been going on for centuries between the East and the West. Consequently he begins with what he considers to have been its causes, and introduces digressions and episodes which had a more or less close connection with his subject. But his work is not merely a bare narrative of facts. Herodotus had a theory of history, partly philosophical, partly theological, and the facts are marshaled and interpreted in accordance with it. The theory was a modification of the old Greek belief in "the golden mean." Whatever exceeded a just proportion was supposed to excite the envy of the gods, and to bring with it punishment and disaster; hence it was that the pride and power of Xerxes were doomed to failure.

The history of Herodotus met with hostile criticism from the first. Thucydides corrected some of its

statements; Ctesias contradicted in detail the parts of it which relate to the East. As a matter of fact, the work of Herodotus contains much that is derived from popular legend and the fictions of the professional dragoman, and in so far is an invaluable storehouse of ancient folklore. Nor did Herodotus possess much critical judgment: where more than one version of an event had come down to him, he preferred that which best illustrated his theory of the working of destiny. Moreover, he borrows from his predecessors without acknowledgment, in accordance with the general custom of the day; indeed, it is often difficult to say whether he is using the words of another writer or really describing his own experiences. Wherever he is describing his own experiences he is thoroughly trustworthy, even though his ignorance of foreign languages made him dependent on his dragoman, and sometimes mistaken in his interpretation of what he saw. He is sometimes called the father of history. The best known English translation is that of George Rawlinson (4 vols., 1858-60). See THE PYRAMIDS OF EGYPT (Front End Papers, Vol. 1).

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**HEROIC VERSE**, the name applied to the English rhyming decasyllable, with a well-marked break in the sense after each second line, as distinguished from the form in which the sense overflows from one couplet into another. It was chiefly used by DRYDEN.

**HEROIN** is an artificial derivative of MORPHINE. Its dangerous addiction liability (see DRUG ADDICTION) led to the prohibition of its importation and manufacture in the United States by an Act of Congress. Heroin is about four times as potent, but also about four times as toxic, as morphine. It is a powerful respiratory depressant and suppresses the cough reflex by central action. It is very rarely employed now in intractable irritating coughs of pulmonary tuberculosis or severe bronchitis. It is said to produce nausea and constipation less frequently than morphine. The absence of the gastrointestinal effects and experience of intense elation and rapture accelerate the acquisition of heroin habit. The heroin habit is said to be more serious than morphine addiction, causing a more rapid and more complete mental and physical deterioration. The addicts usually take heroin like cocaine—by sniffing. Heroin, or diacetylmorphine ( $C_{21}H_{23}O_5N$ ) is a white, odorless, bitter crystalline powder. It is used as its salt, the hydrochloride, which is soluble in water and in alcohol.

THEODORE KOPPANYI

**HÉROLD, LOUIS JOSEPH FERDINAND**, 1791-1833, French opera composer of the Romantic school, whose works are rarely heard today, although they were important in the early part of the 19th century. Hérold was educated at the Paris Conservatoire and won the Grand Prix de Rome in 1812. While in Italy, he devoted his time to chamber music, and wrote two symphonies, which were acknowledged to be of worth. On his return to France, he formed a contract with François Adrien Boieldieu, and collaborated with him in the writing of several works in the style of the Opéra Comique. Of these the most popular were *La clochette* (1817) and *Le muletier* (1824). From 1820 to 1827 Hérold was connected with the Italian opera and made several trips to Italy to engage singers. During this period he wrote many pianoforte compositions, some based on French folk songs. He also became interested in ballet music and wrote several excellent ballets of which *La sonnambule* (1827) and *La belle au bois dormant* (1827) are still performed. His outstanding opera is *Zampa* (1831), which has been called the "French Don Giovanni." It reflects the influence of Rossini and Von Weber. Even more popular with the French public was *Le pré aux clercs* (1832), a gay opéra comique which uses a national poem and a historical subject. Also popular in France was *Ludovic*, which Halévy completed after Hérold's death.

ANNE AND MARX OBERNDORFER

**HERON**. See HERO OF ALEXANDRIA.



Herodotus



CHICAGO NATURAL HISTORY MUSEUM

**Great blue heron**

**HERON**, a long-legged, slender-bodied bird belonging to the family *Ardeidae*. Herons are shy birds, solitary during feeding, but breeding in large colonies, making rude nests of sticks in trees, and laying greenish or bluish unspotted eggs. They are most numerous in hot countries. Typical wading birds, they are rarely seen walking on dry ground, and are fond of standing motionless in shallow water on the watch for prey, usually fishes, which are caught by a sudden thrust of the long beak. They also will eat many small animals, especially frogs and lizards. Herons were formerly protected in Europe on account of the sport they afforded with falcons.

America has many species of herons, most numerous in the southern states. A common species of the temperate parts is the green heron, *Butorides virescens*, whose flesh is much esteemed. Other important species are the great blue heron, *Ardea herodias*, the great white or Florida heron, *A. occidentalis*, the American EGRET, *Casmerodius albus*, and the snowy egret, *Egretta thula*.

**HEROPHILUS**, fl. 285 B.C., a Greek physician and surgeon, was born in Chalcedon, Bithynia. Settling at Alexandria, Egypt, about 285 B.C., he was one of the founders of the medical school there. His conduct of post-mortems led to the practice of dissecting the bodies of both humans and animals. He described the retina and optic nerve of the eye, the cerebrum, cerebellum, and meninges of the brain, and the ovaries, uterus, prostate gland, and other sex organs. Besides distinguishing between sensory and motor nerves, he discovered the function of the arteries in the circulation of the blood and devised a method of taking the pulse by using a water clock. He also studied the liver, pancreas, and spleen and gave the first portion of the small intestine its present name of duodenum.

**HERPES**. See COLD SORES.

**HERRERA, FRANCISCO DE**, 1576–1656, Spanish painter, was born in Seville. Called “El Viejo” (the elder), to distinguish him from his son, “El Mozo” (the younger), he was a man of violent temper. He alienated his wife and children and drove away his pupils, among whom was Velasquez. Accused of coining false money, he took refuge in the Jesuits’ College, Seville. Here he painted “St. Hermengild in Glory” which won him a pardon from Philip IV. His other pictures include “Fall of Manna,” “Christ Disputing with the Doctors,” and “Israelites Gathering Manna in the Desert.”

**HERRERA, FRANCISCO**, called **El Mozo**, 1622–85, Spanish painter, son of FRANCISCO DE HERRERA, born in Seville. He fled from his father’s cruelty to Rome, and there became renowned for his depiction of still life, flowers, fruit, and fish. On his father’s death he returned to Seville and became subdirector of the Academy under Murillo. In 1661 he went to Madrid, where he was appointed painter to the king, and was commissioned to decorate the chapel of the church of Our Lady of Atocha. These frescoes, “The Assumption of the Virgin,” are his chief work.

**HERRESHOFF, JOHN BROWN**, 1841–1915, American naval architect, was born in Bristol, R.I. Although he became totally blind at the age of 15, he won a great reputation by his skill in designing vessels. He began to build yachts at Bristol in 1864, and after 1870 designed and built steam as well as sailing vessels, including torpedo boats and small craft for the United States, British, Russian, and Spanish governments. He and his brother Nathaniel designed several defenders of the America’s Cup.

**HERRICK, ROBERT**, 1591–1674, English poet, was born in Cheapside, London, and was educated at Cambridge. He was the seventh son of Nicholas Herrick, a goldsmith, who died in 1592, probably a suicide. The children were brought up by their uncle, Sir William Herrick, one of the richest goldsmiths in London, and for a time Robert was apprenticed to him. In 1629 Herrick became vicar of Dean Prior in Devonshire, but he was ejected from his parish by the Long Parliament in 1647 because he supported the Royalist cause and openly opposed the growing Puritan power.

Herrick never married but lived in the vicarage surrounded by a family of pets and attended by a devoted housekeeper. At first he found the solitude of his rustic parish oppressive but he soon began to appreciate the quiet charm of Devonshire. He saw the beauty of English country life as no one before him had ever pictured it and he described this beauty with vigor and freshness. In some of his most characteristic verses he has immortalized the Morris dances, Christmas mummers, Twelfth Night revels, and the wakes and quintains of Dean Prior.

In 1648 he returned to London, where he published a collection of his poems in two parts, entitled *Hesperides* and *Noble Numbers*. After the Restoration he resumed his old charge at Dean Prior where he remained until his death.

Gay, gallant, and hedonistic, Herrick was a typical Cavalier poet. His over 1,200 poems cover a wide range, including epigrams, occasional verse, trivial, pagan love lyrics, and sedate, devotional pieces. Subject matter is often sacrificed to form, but throughout his poems one is constantly aware of his inspired choice of words evocative of music and color. Typical of his miniature lyrics are the popular “Corinna’s Going A-Maying,” “Cherry Ripe,” and “To the Virgins to Make Much of Time.” S. W. X.

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**HERRICK, ROBERT**, 1868–1938, American novelist, was born in Cambridge, Mass., and educated at Harvard. He was a member of the English department of the University of Chicago from 1893 to 1923, becoming a full professor in 1905. He published a number of novels of the muckraking variety, including *The Common Lot* (1904), *A Life for a Life* (1910), *Clark’s Field* (1914), and *Chimes* (1926). *The Master of the Inn* (1908), his most popular novel, described the physical and moral collapse of the city dweller in his struggle with the complexities of modern life. Among his other works are *The Man Who Wins* (1897), *One Woman’s Life* (1913), *The End of Desire* (1932), *Sometime* (1933).

**HERRIN**, city, Illinois, Williamson County, on the Burlington, the Illinois Central, and the Missouri Pacific railroads, 80 miles SE of St. Louis, Mo. Herrin, the principal center of the southern Illinois



coal fields, was settled in 1816 by Ephraim S. Herrin. Here in 1922 occurred the Herrin massacre, when 24 miners were killed during a strike. Coal mining is the principal industry. Pop. (1950) 9,331.

**HERRING**, an important food fish of the family *Clupeidae*, which includes many genera and over 100 species, most of them occurring in salt water. They are found in all northern seas, not far from the land. They furnish an important food supply and herring fisheries constitute a valuable industry. All members of the herring family are "surface" or "migratory" fishes, swimming in shoals, usually in midwater or near the surface, and feeding principally on minute organisms, especially crustacea, which they strain from the water by means of the sieve-like arrangement of the gill-rakers, in much in the same manner as the whalebone whales obtain their food. The herring, however, also lives upon pelagic worms (*Sagitta*), and at certain seasons on fry of its own and other species; it is itself the prey of predatory fishes, cetaceans, and birds, which follow the shoals as they approach the coast to spawn. The eggs are deposited on the bottom on stones, gravel, or seaweed, to which they adhere, usually near the shore in comparatively shallow water. The number of eggs deposited by a female ranges from about 10,000 to 60,000, according to her size, the mean number being about 31,000; the time taken for the embryonic fish to hatch out varies with the temperature from 8 to 9 to over 40 days. At the end of one year the young are about five inches in length; they attain maturity when seven or eight inches long, at two or three years.

The common herring, *C. harengus*, is found throughout the North Atlantic. It is about 12 inches long, bluish in color, silvery beneath. The California herring, *C. pallasi*, closely resembling its eastern prototype, is found in great abundance the length of the North Pacific. Other species, known as sardines and shad, occur on both the Atlantic and Pacific coasts and in the Great Lakes. Herring fisheries are exceedingly important in Europe and America, the chief centers being the North Sea in Europe and from the Bay of Fundy to Cape Cod in America. It is estimated that world production of herring is over 4,275,000,000 pounds. Herring are sold fresh, smoked, salted, or pickled, packed as **SARDINES**, or used as bait in cod fishing. See **FISHERIES**.

**HERRIOT, ÉDOUARD**, 1872-1957, French statesman, was born in Troyes. After graduating from the École Normale Supérieure, he taught rhetoric in Nantes and Lyons lycées. In 1905 he became mayor of Lyons, a position he held to 1942. He served in the national Senate (1912-19) and Chamber of Deputies (1919-42); was minister of public works (1916-17), of public education (1926-28), and of state (1934-36); and, as leader of the Radical Socialist party, was premier of France three times (1924-25, 1926, 1932), and president of the Chamber of Deputies (1925, 1936-42). Herriot, an anticollaborationist, was interned in 1942 for denouncing Pétain's dissolution of Parliament. Liberated from a German concentration camp in 1945, he was re-elected mayor of Lyons; resumed leadership of the Radical Socialist party; and was elected president of the National Assembly (1947, re-elected 1951). In 1951 he resigned his party chairmanship only to resume it a few weeks later, when the Radical Socialists decided against coalition with the De Gaullists.

**HERRNHUT**, village, Germany, in the state of Saxony, 35 miles SE of Bautzen. It was founded in 1722 by some Moravian families who left their country because of religious persecution. Here under the protection of Count Zinzendorf was laid the foundation of the modern Moravian church. The village has a monument to the count, a theological seminary, and other buildings devoted to religious use. Pop. 1,700.

**HERSCHEL, CAROLINE LUCRETIA**, 1750-1848, astronomer, sister of **SIR WILLIAM HERSCHEL**,

was born in Hanover, Germany. Having gone to England (1772) to live with her brother at Bath, she assisted him in his astronomical research and, when he was appointed astronomer royal, acted as his assistant. She discovered eight comets, between 1786 and 1797, and many of the smaller nebulae and star clusters included in Sir William Herschel's catalogue. In 1798 she published for the Royal Society *Catalogue of Stars Taken from Mr. Flamsteed's Observations*.

**HERSCHEL, Sir JOHN FREDERICK WILLIAM**, 1792-1871, English astronomer, son of **SIR WILLIAM HERSCHEL**, was born in Slough, Buckinghamshire. He was educated at St. John's College, Cambridge, and in 1816 translated Lacroix's *Elementary Treatise on the Differential Calculus*, with an appendix on *Finite Differences*, which was succeeded in 1820 by two volumes of *Examples*, prepared in collaboration with Babbage. Herschel became Copley medalist in 1821, and for a time was associated with Sir James South on a re-examination of his father's star catalogues. In 1834 he established an observatory at Feldhausen, near Cape Town, South Africa, for four years studied the southern heavens, discovering 1,202 pairs of close double stars and 1,707 clusters and nebulae. He was master of the mint from 1850 to 1855. Beside carrying out his important astronomical studies, Herschel was a proficient chemist and invented the photographic use of sensitized paper, discovered the use of hyposulfite of soda as a fixing agent, and made valuable researches on the undulatory theory of light. He wrote *Outlines of Astronomy* of which 10 editions appeared (1849-69), and miscellaneous works published as *Collected Addresses* (1857) and *Familiar Lectures on Scientific Subjects* (1866). Herschel was knighted in 1838. He was buried in Westminster Abbey.

**HERSCHEL, Sir WILLIAM**, originally **Friedrich Wilhelm**, 1738-1822, British astronomer royal, regarded as the founder of sidereal astronomy. He was born in Hanover, Germany, and was educated as



YERKES OBS.

**Sir Wm. Herschel**

a musician, being especially adept in playing the oboe and the organ. Going to England in 1757, he became an orchestra conductor in Leeds and Halifax and was an organist in Bath. His hobby was astronomy and, with the assistance of his sister Caroline, he constructed his first reflecting telescope (1773-74). With this seven-inch reflector he discovered in 1781 the first major planet to be discovered since ancient times. He called it Georgium Sidus in honor of George III, but today it is

known as **URANUS**. The sovereign reciprocated by knighting Herschel and appointing him court astronomer. The Royal Society bestowed on him its Copley medal and elected him a Fellow.

In 1789 Herschel erected the 40-foot focal length telescope with which he discovered the sixth and seventh satellites of Saturn and the two bright satellites of Uranus, Oberon, and Titania. He also determined the period of rotation of Venus and Saturn (with its rings), studied the features of Mars, and discovered that the double stars are true binaries linked by gravitation. He was the first to suggest that sunspots influence the earth's weather and bestowed the name asteroid on the smaller planets. While studying the proper motions of certain stars he arrived at the conclusion that the solar system is moving toward an apex in the constellation Hercules and that the myriad of other galaxies constitute islands of matter moving forward in gigantic orbits in an infinite ocean of space. His principal publications were *Motion of the Solar System in Space* (1783) and a catalogue of about 2,500 new nebulae and

star clusters which he began to classify in 1783. See *ASTRONOMY, Photography and Spectroscopy*; *INVENTION AND DISCOVERY* for illustrations. M. E. C.

**HERSEY, JOHN**, 1914–, American journalist and novelist, was born in Tientsin, China, where his parents were employed in missionary work. He graduated from Yale University in 1936, did a year of postgraduate work at Clare College, Cambridge, and in 1937 joined the staff of *Time* magazine as a correspondent. During World War II he reported action in both the Pacific and Mediterranean theaters. His books include *Men on Bataan* (1942), *Into the Valley* (1943), *A Bell for Adano* (1944, Pulitzer prize), *Hiroshima* (1946), *The Wall* (1950).

**HERSHEY, LEWIS BLAINE**, 1893–, American general, was born on a farm near Angola, Ind. He attended Tri-State College and the University of Indiana, and planned to become a teacher, but service in World War I turned him into a soldier instead. After the war he joined the regular Army, and became a major in 1935. When the Selective Service Act was passed in 1940, Colonel Hershey became director of the Selective Service system. He was made a brigadier general in 1940 and was known chiefly for his work as a manpower mobilizer.

**HERSHEY, MILTON SNAVELY**, 1857–1945, American manufacturer and philanthropist, was born in Dauphin County, Pa. He opened his first candy shop in Philadelphia at the age of 21 and then continued the same line of work in New York City. After 25 years Hershey sold his business for \$1,000,000 and began the manufacture of chocolate in Lancaster, Pa. With his capital he established the town of Hershey, a workers' community. In 1905 Hershey and his wife started the Hershey Industrial School for orphan boys. Maintained until they are 18 years old, the boys may choose any trade which will make them self-supporting at that time. In 1918 Hershey transferred about \$60,000,000 to a trust-fund company for maintenance of this school.

**HERSHEY**, a privately owned, unincorporated community, SE Pennsylvania, Dauphin County, on the Reading Railroad, and U.S. Highway 422, about 13 miles E of Harrisburg. The community was established in 1903 by MILTON HERSEY; the Hershey Chocolate Corporation dominates the town. It has a hospital, inn, theater, and park. Pop. (1950) 6,076.

**HERSTAL**, or *Héristal*, town, Belgium, in the province of Liège, on the Meuse River, two miles N of the city of Liège of which it is a suburb. Herstal has iron and steel manufactures, a small arms factory, and a cannon foundry. Its industries were taken over by the Germans in 1940. British and American forces liberated the town, with Liège, on Sept. 8, 1944. More than 58 per cent of its buildings were destroyed by robot bombs. Pop. (1949) 27,092.

**HERTFORDSHIRE**, or *Herts*, inland county of SE England, bounded on the N by Bedford and Cambridge, E by Essex, S by Middlesex, and W by Buckingham; area 632 sq. mi.; pop. (1950) 601,000. The surface of the shire is undulating, traversed by chalk ridges continuous with the Chiltern Hills and the East Anglian Heights. Hertfordshire is drained by the Colne, Stort, and Lea rivers. The New River, an artificial channel constructed to supply North London with water, is fed by springs at Amwell and Chadwell. Branches of the Grand Junction Canal afford water communication. Hertfordshire is primarily an agricultural region; crops raised include wheat, oats, corn, barley, beans, sugar beets, potatoes, and turnips. Through the fertile Vale of St. Albans, extending centrally through the county, are numerous grain, orchard, and berry farms. Fruits produced are pears, apples, cherries, and strawberries. Watercress is also grown extensively. Cattle and sheep are raised. Industries include iron foundries, tanneries, breweries, and the manufacture of strawplait, silk goods, bricks and tiles, brushes, gloves, and paper. The most important towns are Hertford, the county

town, ST. ALBANS, WATFORD, Letchworth, and Hitchin.

**HERTLING, GEORG, COUNT VON**, 1843–1919, German philosopher and statesman, was born in Darmstadt and became professor of Catholic philosophy at the University of Munich (1882–1912). In the German Reichstag (1875–1912), he belonged to the Center (Catholic) party, whose leader he became in 1909. In 1891 he became a life member of the Upper Chamber of the Bavarian parliament. Prime minister of Bavaria from 1912 to 1927, he became chancellor of the German Reich on Nov. 1, 1917, and held that office when the peace treaties of Brest-Litovsk and Bucharest were concluded. He resigned in October, 1918.

**HERTOGENBOSCH**. See 's HERTOGENBOSCH.

**HERTS**. See HERTFORDSHIRE.

**HERTZ, GUSTAV**, 1887–, German physicist, was born in Hamburg and studied at the universities of Göttingen, Munich, and Berlin. He joined the Berlin faculty as an instructor in its Physical Institute in 1913. From 1920 to 1925 he was employed in the physical laboratory of the Philips Incandescent Lamp Factories in Eindhoven, the Netherlands. He was professor of physics at the University of Halle (1925–28) and director of the Physical Institute at the Berlin Polytechnic Institute from 1928. In his early research he was associated with JAMES FRANCK in formulating the laws governing the impact of electrons on atoms. These laws furnished the first proof of the validity of the quantum theory proposed by MAX PLANCK. Hertz also measured ionization potentials of various gases such as neon and argon and studied the results of electron impacts in the excitation of spectral radiation. He shared the 1925 Nobel prize in physics with Franck.

**HERTZ, HEINRICH RUDOLF**, 1857–94, German physicist, was born in Hamburg. He received his final training in experimental and mathematical physics in Berlin under Helmholtz, became privat-docent at Kiel (1883), and professor of physics in the technical high school at Karlsruhe (1885–89), and at the University of Bonn (1889–94). While at Karlsruhe he carried out his remarkable experiments on electric waves, the existence of which formed the central feature of Maxwell's theory of electricity and magnetism (see *ELECTROMAGNETIC WAVES*). Hertz was able to demonstrate experimentally the existence of electromagnetic waves of comparatively low frequency. Having proved the existence of electric waves propagated through space, he showed that they could be reflected, refracted, polarized, and diffracted, just as light is. He also measured the velocity of propagation, and found it to be of the same order as that of light and radiant heat. Wireless telegraphy is the practical development of the experimental facts established by Hertz, and gives to the Hertzian waves an added importance. Hertz also wrote valuable memoirs on problems in elasticity, and published shortly before his death a profound treatise on the foundations of dynamics. His writings were translated into English by D. E. Jones, as *Electric Waves, Miscellaneous Papers, and Principles of Mechanics* (1899). See MARCONI AND WIRELESS TELEGRAPHY (Front End Papers, Vol. 19); RADIO.

**HERTZIAN WAVES**. See HERTZ, HEINRICH RUDOLF; *ELECTROMAGNETIC WAVES*; RADIO.

**HERTZOG, JAMES BARRY MUNNIK**, 1866–1942, South African statesman, was born in Wellington, Cape Colony, and studied at Victoria College, Stellenbosch, and Amsterdam University. Admitted to the bar, he became an advocate in Bloemfontein and a judge in the Orange Free State (1895). During the South African War (1899–1902) he commanded the Boer forces of the Southwestern Division with the rank of general. Although he had encouraged the maintenance of hostility to the British after the war, he was chosen minister of justice in the first Union cabinet (1910–12). In 1913 he organized the Nationalist party, whose goal was complete independence



from Great Britain. It actively opposed the policy advocated by Jan Christiaan Smuts of development of the Union of South Africa within the British Empire as a self-governing dominion. The schism between the Boer and British elements was somewhat healed in 1924 when Hertzog became prime minister. He held this office until 1939 when he was defeated because he opposed support of Britain at the beginning of World War II. He also served as minister of native affairs (1924-29) and as minister of external affairs (1929-39).

**HERULI**, or **ERULI**, a Teutonic people, who, in the fifth century, A.D., invaded the Roman Empire, and, under the command of ODOACER, put an end to the Western Roman Empire A.D. 476.

**HERVEY ISLANDS**. See **COOK ISLANDS**.

**HERWEGH, GEORG**, 1817-75, German lyric poet, was born in Stuttgart. In 1841 he published a volume of political poems *Gedichte eines Lebendigen*, which was confiscated by the German police but which, nevertheless, attained great popularity. He joined the Radical party in Paris in 1845 and two years later raised a German democratic legion for the invasions of Baden, intending to establish a revolutionary government there, but, failing in his attempt, fled to Switzerland. He published a second volume of *Gedichte eines Lebendigen* (1844), translated Lamartine's *Complete Works* (12 vols., 1843-44), and several plays of Shakespeare.

**HERZEGOVINA**. See **BOSNIA-HERCEGOVINA**.

**HERZEN, ALEXANDER**, 1812-70, Russian author and publicist, was born in Moscow. He was exiled to Siberia in 1834, because of his too liberal political views, but returned to Moscow in 1842. He left Russia in 1846, and eventually established (1851) a printing press in London to advocate the cause of reform in his own country. Thence his two periodicals, the *Polar Star* and the *Bell (Kolokol)*, were smuggled into Russia in thousands. Later on, when Herzen espoused (1863) the cause of Poland, he lost all influence with his countrymen. He edited the works of Pushkin, Lermontov, and other Russian writers, and his own works (Russian) appeared in 10 vols. (1875-85) at Geneva. He frequently used the pseudonym of "Iskander." His translated works include *My Exile to Siberia* (1855) and *Memoirs of the Empress Catherine II* (1859).

**HERZL, THEODOR**, 1860-1904, founder of the Zionist movement, was born in Budapest. In his thirties, stunned by the anti-Semitism which survived every liberal triumph, he rejected the assimilationist views that he had entertained and organized the Zionist movement to secure for the Jewish people a legally assured homeland in Palestine. Herzl died before any diplomatic triumphs had been won, but he stimulated the nationalism of Jews so that it deeply affected their religious, cultural, and social life. Herzl wrote *The Jewish State* (ed. 1946). He was reburied in Palestine in 1949. A. L. SACHAR

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**HESHBON**, a Levitical city, Palestine, located on the border between Gad and Reuben on the plateau above the NE corner of the Dead Sea. It belonged first to the Moabites and later to the Amorites. Finally, it was again possessed by the Moabites. (Num. 21:28; Judg. 11:26; Cant. 7:4; Isa. 15:4; Jer. 48:2.)

**HESIOD**, fl. ninth or eighth century B.C., after Homer, the most famous of the early poets of Greece. The ancients usually considered him and Homer as contemporaries; but it is certain that Hesiod lived long after Homer. Herodotus' date for Hesiod (about 860 B.C.) would seem to be fairly accurate, though many authorities place him about 750 B.C., or even later. Hesiod's father migrated from Cume in Asia Minor to Ascra in Boeotia, where Hesiod was born. Later, Hesiod is said to have moved to Orchomenus, and to have died there; there, at any rate, his tomb

was shown in later days, though Thucydides mentions a tradition that he was killed in the temple of Nemean Zeus at Oeneon in Locris by the inhabitants of the place. The story that he and Homer had a contest for the prize of poetry is amply disproved by their difference in dates.

Hesiod left only two poems which can be considered genuine—*Works and Days* and *Theogony*—though the authenticity even of the latter is suspected by some critics. *Works and Days* is the earliest didactic poem known to us in Greek. Its subject is the right methods of husbandry, the due observance of the proper seasons, and a sort of calendar; it contains many precepts on household management, commerce, the choice of a wife, navigation, and the education of children. Yet there is poetry in various episodes in the work—viz., the fable of Prometheus and Pandora, the account of the different ages of the world, and a description of winter. There is also much vigor of thought in the moral and political maxims with which the work abounds. *Theogony* tells of world creation, the ocean, earth, heaven, stars, and gods.

**HESPELER**, town, Canada, in the S of Ontario Province, in Waterloo County, on the Speed River and the Canadian National Railway, 14 miles E of Kitchener. Formerly called Bergeyville and New Hope, it was renamed in honor of Jacob Hespeler, who aided its economic development after 1844. Located in a farming district, the town has woolen and flour mills and factories making graniteware. Pop. (1951 census) 3,862.

**HESPERIDES**, the daughters of Hesperus, were in Greek mythology the guardians of the golden apples given by Gaia to Hera on her marriage with Zeus. The earliest legends make them dwell on the river Oceanus in the farthest West; other accounts associate them with the giant Atlas, and place them on Mount Atlas.

**HESPERUS**, in Greek mythology the son of Astraeus and Eos and the father of the Hesperides. He was identified with the evening star, which the Romans called Vesper and which is now known as Venus.

**HESS, Dame MYRA**, 1890—, British pianist, was born in Hampstead, near London. She began her musical training at the age of 5 and in 1902 began work with Tobias Matthay at the Royal Academy of Music. She made her debut in 1907 with the London Philharmonic Orchestra. Touring America for the first time in 1922, she was recognized as one of the world's great pianistic talents. Endowed with great technical powers, her playing was highly communicative, marked by deep, poetic feeling and flawless taste. In 1936, Myra Hess became the first instrumentalist to be awarded the rank of Commander in the Order of the British Empire. King George VI made her a Dame Commander in 1941. During World War II she gave noon hour concerts in blitzed London.

**HESS, RUDOLF**, 1894—, German political leader, was born in Alexandria, Egypt. He met Adolf Hitler during World War I, and they were imprisoned together (1923) after the Munich beer hall uprising. Hess wrote the manuscript of *Mein Kampf* from Hitler's dictation and acted as his private secretary. He became a member of the National Socialist party (1920), was chairman of the central political committee (1932), deputy leader (1933), and a member of the puppet Reichstag which brought the republic of Germany to an end. In 1933 he was appointed minister without portfolio. Hitler declared him second in succession to the dictatorship (1936), and in 1938 he became a member of the secret cabinet council. With the possible exception of Hermann Goering he was Hitler's closest friend and adviser in 1940. He flew to Scotland (1941), made a parachute landing, and was held by British authorities for the duration of World War II. The most widely accepted explanations of his flight are either that he had broken with Hitler over German-Russian relations or that

he carried German peace proposals. In 1946 he was sentenced to life imprisonment by the International Military Tribunal at Nuremberg. See **WAR CRIMES**.

**HESS, VICTOR FRANCIS**, 1883–, Austrian-American physicist, was born in Waldstein, Austria, and studied at the universities of Graz and Vienna. He was professor of experimental physics at the University of Graz (1925–31), the University of Innsbruck (1931–37), and Fordham University in New York City from 1938. While at Innsbruck he acted as director of the university's Institute of Radiation Research and in 1931 founded a cosmic ray observatory atop a Tirolean mountain. His observations established the fact that the intensity of cosmic rays increases with altitude, that their number varies with latitude, and that they are about 1.5 per cent stronger in the daytime than at night. He also investigated the earth's radioactivity and the electrical conductivity and ionization balance of the atmosphere. His work on cosmic radiation won him a share (with **CARL D. ANDERSON**) in the 1936 Nobel prize for physics.

**HESS, WALTER RUDOLF**, 1881–, Swiss physiologist, was born at Frauenfeld. He won his doctorate in medicine in 1906, after study both in Switzerland and Germany. He began his career in Zürich University, and from 1931 to 1936 was director of the research station, Jungfrauoch, Switzerland. Hess shared the 1949 Nobel prize for medicine with **EGAS MONIZ** of Portugal, for brain research showing how the middle brain co-ordinates the functioning of the internal organs.

**HESSE, HERMAN**, 1877–, German novelist, was born in Calw, a village in the Black Forest. In his youth he traveled extensively in Italy and in India, where his father and grandfather were missionaries. His education was divided between Germany and Switzerland. As a boy he studied in a classical school and in a seminary, and later became a minister. For a time he was a bookseller. His first novel, *Peter Camenzind*, partly autobiographical, was published in 1904. In 1912 he settled in Switzerland, becoming a Swiss citizen. The dominant theme of his novels is the subjugation of the individual by the tyranny of the modern masses. His books translated into English include *Gertrude and I* (1915), *Demian* (1923), *Steppenwolf* (1929), and *Death and the Lover* (1932). He was awarded the 1946 Nobel prize for literature.

**HESSE**, or **Greater Hesse**, German **Grosshessen**, a German state set up in 1945 by the Americans as a part of their occupation zone; it consists of the former territory of **HESSE-DARMSTADT** on the east bank of the Rhine, and the Prussian province of **HESSE-NASSAU**, with the exception of four rural districts; area 7,931 sq. mi.; pop. (1946) 4,064,079. A state constitution went into effect Dec. 1, 1946. The capital is **WIESBADEN**.

**HESSE-CASSEL**, German **Hessen-Kassel** or **Kurhessen**, a former electorate of Germany, coinciding with the district of Kassel in the former Prussian province of Hesse-Nassau (1866–1945); area 3,716 sq. mi. It was founded as a landgraviate in 1567 by Landgrave William IV, who partitioned the then existing landgraviate of Hesse. From the middle of the 18th century the landgraves of Hesse-Cassel were wont to hire out their subjects as mercenary soldiers, in great part to Great Britain. Landgrave Frederick II in 1776 sold 19,000 of his subjects to the British government for the sum of 21.25 million thalers. Those were the soldiers known as Hessians who fought the armies of George Washington on behalf of George III of England. In 1803, Landgrave William IX was granted the rights of an elector of the empire; but in 1807 he was compelled to transfer his territories to the kingdom of Westphalia, which Napoleon had set up for his youngest brother, Jérôme, and of which Kassel was chosen the capital. He recovered them, however, in 1813. In the war of 1866 the elector sided with Austria against Prussia and as a result

lost his land, which was incorporated as a province in Prussia. See **Hessian Mercenaries**.

**HESSE-DARMSTADT**, former grand duchy, later a constituent state of the German republic (see **GERMANY, History**), consisted principally of two separate portions: Upper Hesse on the north side of the Main; and Rhenish Hesse and Starkenburg on the south side of the Main but divided from each other by the Rhine; area 2,965 sq. mi. The southeast of Starkenburg is filled by the Odenwald, known in the saga of Siegfried (see **NIBELUNGENLIED**) as the place where he was slain. The east of Upper Hesse is filled in part by the volcanic Vogelsberg (2,500 ft.). The valleys of the Rhine and the Wetterau are both districts of great fertility. Wine is one of the principal products. Forests cover nearly one-third of the surface. There is considerable manufacturing industry—ironworks, factories for machinery, automobiles and trucks, leather goods, chemicals, furniture, tobacco, hats, soap, pharmaceutical products, matches, sausages, sugar, beer, spirits, woodenwares, and silverware. Breeding of cattle and horses plays a large role. There are mineral springs at Nauheim and elsewhere. There was a university at Giessen, but the town has been completely destroyed (1945). The capital was **DARMSTADT**.

**History.** Hesse-Darmstadt owed its foundation to the first landgrave, George (1567–96). Napoleon made it a grand duchy in 1806, and in 1816 Grand Duke Louis I assumed the title of "Grand Duke of Hesse and of the Territories Adjacent to the Rhine." Hesse-Darmstadt became a member of the German Confederation (1815–66), and Louis I was among the first German princes to grant his country a written constitution (1820). In 1866 the grand duchy sided with Austria against Prussia. Defeated in the war, Hesse-Darmstadt had to give a slice of its territory to Prussia and to pay an indemnity, and was compelled to have its northern part become a member of the North German Federation (1867). In 1871 the entire grand duchy became one of the constituent states of the new German Empire. During the German revolution (1918) the grand duke abdicated; a republic was proclaimed under the name of *Volksstaat Hessen* ("the peoples' state of Hesse"). It was one of the constituent states of the Weimar Republic (see **GERMANY**). The Hessian railroads, which had been amalgamated with the state-owned Prussian railroads in 1896, were taken over by the German Reich in 1920. The state of Hesse-Darmstadt was made a Reich province by Hitler in 1934 and administered by a Nazi appointed governor. In 1945 the Americans made Hesse-Darmstadt part of the state of Greater Hesse (German *Grosshessen*). That new state was granted partial self-government under American supervision. See **MAINZ**; **WORMS**.

**HESSE-HOMBURG**, former landgraviate of Germany, composed of the district of Homburg vor der Höhe and that of Meisenheim, on the right and left banks of the Rhine respectively; area 106 sq. mi. From 1866 it belonged to Prussia. In 1945 it became a part of the state of Greater Hesse (German *Grosshessen*), which was set up by the Americans and granted partial self-government under American supervision.

**HESSE-NASSAU**, former Prussian province of Germany, between the Rhine and the Weser rivers. The surface is mostly hilly, and two-fifths of the area is in forest. The Nassau section includes the Taunus (1,500–2,000 ft.), the Westerwald (1,000–2,160 ft.), and the Hessian Bergland (1,200–2,500 ft.). The province is drained by the Rhine, Main, Lahn, Fulda, and Werra. Wine is the principal product of Nassau proper, the **RHEINGAU** yielding several of the most valuable and famous of the **RHINE OR RHENISH WINES**: Rudesheimer, Johannisberger, Steinberger. Fruits and vegetables are largely grown. The Taunus region is famous for its mineral water resorts, such as **WIESBADEN** and **Ems**. There is a good deal of manufacturing.



**History.** Nassau was a county from 1160 on when Walram I of Laurenburg assumed the title of Count of Nassau. In 1255 the family split into two branches: the Ottonian, or Orange branch, the younger, which became the reigning family of the Netherlands and of which Queen Wilhelmina is a direct descendant, and the Walramic, or elder, branch, which reigned in the county (later principality) of Nassau. In 1806 Nassau became a duchy. Duke Adolf in 1866 sided with the Austrians against Prussia. The Prussians occupied his capital, Wiesbaden, expelled him, and incorporated his land in the kingdom of Prussia. In 1890 he became Grand Duke of Luxembourg, where his descendants still reign.

In 1868 Prussia united the conquered lands of Hesse-Cassel, Nassau, the Free City of Frankfurt am Main, and some other territories under the name of province of Hesse-Nassau, commonly called the Prussian province of Hesse. KASSEL was made the capital. In 1945 the Americans amalgamated the Prussian province of Hesse-Nassau with the former German state of HESSE under the name of Greater Hesse (German *Grosshessen*) as a state with partial self-government under American supervision.

**HESIAN FLY**, a gall gnat, popularly supposed to have been introduced into North America by the Hessian troops during the Revolutionary War. The adult female is a small fly under one-tenth of an inch in length, with hairy legs, and is velvety black with blood-red markings. The male is larger and rather different in color. During April the two sexes enjoy their brief period of aerial life, and then die. The eggs are laid on leaves of wheat, and the larvae, as soon as hatched, crawl down to the stem and burrow in it. Here they spend the whole of their larval and pupal life, the summer brood of flies emerging at the end of August or the beginning of September. These again pair, and a fresh supply of eggs is laid on winter wheat, the resulting larvae passing the winter in the pupal stage, and giving rise to the spring brood of flies. Both sets of larvae are very destructive to wheat, the autumn brood especially so; and other grains are affected. The best preventive against attacks by the Hessian fly, *Phytophaga destructor*, is the late planting of winter wheat and the use of clean farming practices.

**HESIAN MERCENARIES** were extensively used by the British during the American Revolution. Actually, many of the German mercenaries were not Hessians, but the designation was applied to all. Of the 29,875 German mercenaries brought to America 16,992 were from Hesse-Cassel, 5,723 from Brunswick, 2,422 from Hesse-Hanau, 2,353 from Anspach-Bayreuth, 1,225 from Waldeck, and 1,160 from Anhalt-Zerbst. Great Britain was forced to employ such mercenaries because she lacked trained soldiers and she found it difficult to obtain enlistments. After an unsuccessful attempt had been made to secure 20,000 Russian mercenaries the ministry turned to the German states; agreements were made with six princes, three of whom had dynastic connections with George III. Many of the German princes maintained relatively large standing armies, which they were glad to let out for hire to gain additional revenue. For these mercenaries Great Britain paid to the German rulers a total of £1,770,000.

The Germans constituted about one-third of all the king's troops in America; they took an important role in practically every important battle and campaign. Although they fought under British high command they had their own commander, this position being held successively by von Heister, von Knyphausen, and von Lossberg, all Hessians. The Germans distinguished themselves in many battles; the Jäger Corps was regarded as the best unit in the British service.

At first the Hessians were hated and feared by the Americans; later this feeling changed to high respect. As prisoners they were generally well treated, some being bought out of prison by American friends.

Some deserted to the American side under inducements offered by Congress. After the war a large number received permission to remain in the United States. General GEORGE A. CUSTER was descended from one of the latter. Only 17,313 were returned to their homeland; 548 were listed as killed (not including those who died of wounds and other causes). Some received grants in Nova Scotia among the American Loyalists. See REVOLUTION, AMERICAN; UNITED STATES HISTORY.

F. M.

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**HESTIA**, called **Vesta** by the Romans, was one of the 12 chief divinities of ancient Greece; she was the daughter of Cronos and Rhea. She was the goddess of the hearth, or more particularly the fire on it, as representing the center of domestic life. Every town and state had also its central hearth, which was sacred to her, and at which her worship was performed. If this fire ever went out (though great care was always taken to keep it alight), it might not be rekindled with ordinary fire, but only by the sun's rays, or by the friction of two pieces of wood. See VESTAL VIRGINS.

**HESTON AND ISLEWORTH**, municipal borough, England, in Middlesex, a suburb of London, 12 miles SW of St. Paul's. Heston and Isleworth were combined in 1927 and became a municipal borough in 1932. Isleworth is on the west bank of the Thames, and has market gardens, breweries, and a soap works. Heston has the 12th-century Church of St. Leonard and one of the oldest lich gates in England. Its R.A.F. airport was bombed constantly by German air raiders throughout 1940. Pop. (1950 est.) 108,120.

**HESYCHIUS**, Greek grammarian of Alexandria, who lived probably during the fourth century A.D. His only extant work is a dictionary, which is of great value not only for its explanations of existing words, but also as a collection of words otherwise unknown, and as a storehouse of quotations from lost works.

**HETCH HETCHY DAM.** See DAM.

**HETEROCYCLIC COMPOUND.** See CYCLIC COMPOUND.

**HEUSS, THEODOR**, 1884–, German author and political leader. He was editor-in-chief of *Neckarzeitung*, 1912-18, lecturer in the Berlin High School of Politics, 1920-33, and a member of the Reichstag, 1924-33. At first he supported Hitler, but then broke with him. His anti-Nazi book, *Hitler's Way*, was published in 1932, and in the following year he retired from public life. After World War II, Heuss became minister of education in Wurttemberg-Baden, and in 1946 was elected to the Diet. In 1949 he became the first president of the West German Republic. His books include a biography of Friedrich Naumann (1937) and *Werk und Erbe* (1948).

**HEVELIUS**, or **HEVEL, JOHANNES**, 1611-87, German astronomer, was born in Danzig where he succeeded to the management of his father's brewery. In 1641 he erected an observatory in his own house, furnished it with large telescopes of his own design and construction, and devoted most of his leisure time to making astronomical observations. He was particularly interested in sunspots, the transit of Mercury, the nature of Saturn, and the surface of the moon. *Selenographia* (1647) which was illustrated with his own copper engravings laid the foundation of lunarian topography. He also wrote *Cometographia* (1668), *Machina Coelestis* (2 vols. 1673-79), and *Prodromus Astronomiae* (1690).

**HEVESY, GEORG VON**, 1885–, Hungarian-Danish physical chemist, was born in Budapest and studied at the universities of Budapest, Berlin, and Freiburg. He taught physical chemistry at the universities of Copenhagen and Freiburg and was connected with Bohr's Institute of Theoretical Physics in Copenhagen (1934-43 and from 1945). His early research pertained to radioactivity, the separation of

isotopes, and the use of radioactive tracer atoms in investigating diffusion in crystals. He also investigated such biochemical problems as the metabolism of phosphorus in organisms and such physiological problems as the breaking down and rebuilding of the muscle substance called creatine phosphoric acid.

With the assistance of the Dutch physicist, Dirk Coster, Hevesy undertook x-ray investigations in 1922 which led to the discovery of the element HAFNIUM in zirconium ores. He also made a thorough study of the properties of the hafnium compounds, and in later years was interested in the rare earth elements. The 1943 Nobel prize in chemistry was awarded him for his work on the use of isotopes as indicators in studying chemical properties. His writings include *Properties of Hafnium* (1925), *A Manual of Radioactivity* (1939), *Radioactive Indicators* (1948).

**HEWITT, ABRAHAM STEVENS**, 1822-1903, American manufacturer and political reformer, was born in Haverstraw, N.Y., and was educated at Columbia. He was admitted to the bar in 1845, but abandoned the law, and became a partner of Edward Cooper (son of Peter Cooper) in the iron business. Through his efforts the open-hearth process of making steel was introduced in this country. He was a member (Dem.) of Congress in 1874-87, and mayor of New York in 1887-89. He continued after his administration to take an active interest in the city's affairs, and especially in the development of a rapid transit system. He was the benefactor of many of the city's institutions, particularly of COOPER UNION, and was one of the first trustees of the Carnegie Institution.

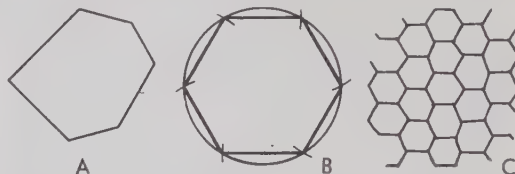
**HEWITT, HENRY KENT**, 1887- , American naval officer, was born in Hackensack, N.J., and studied at the U.S. Naval Academy. During World War I he patrolled submarine-infested waters and escorted convoys. After other peacetime commands and ship duty, he became head of the mathematics department at the Naval Academy (1933-36). At the outbreak of World War II Hewitt organized, trained, and commanded the amphibious forces in the Atlantic Fleet (1942). He commanded U.S. naval landings in French Morocco, planned the American share of the Allied invasion of Sicily with 1,000 ships, furnished naval covering for the invasion of Italy, and as commander of the Western Naval Task Force had charge of the Navy's share in the invasion of southern France. He became an admiral in 1945, conducted Pearl Harbor investigations, and headed U.S. naval forces in Europe. He retired in 1949.

**HEWITT, PETER COOPER**, 1861-1921, American electrical engineer and inventor, was born in New York City, the son of ABRAHAM S. HEWITT and grandson of PETER COOPER. Educated at Stevens Institute of Technology and Columbia College, he became noted for his electrical experiments. He invented the mercury-vapor arc lamp (1903), which has been widely adopted by the printing, the photographic, and other industries because it gives an efficient blue-green light. He contributed to the development of the radio by designing a mercury-vapor rectifier and discovered the fundamental importance of the pilot electrode, or "grid," when inserted in a vacuum-tube amplifier. While he was a member of the Naval Consulting Board (1915-21) he designed an aerial torpedo. He pioneered in developing the hydroplane and with F. B. Crocker built a helicopter which successfully rose from the ground (1918). He was active as a director of the Cooper-Hewitt Company and the Hewitt Realty Company and as a trustee of Cooper Union. See MERCURY-VAPOR LAMP.

**HEWITT, WILLIAM**, known as Billy, 1910-47, American football player, was born in Bay City, Mich. After graduation from the University of Michigan, he played professional football with the Chicago Bears and Philadelphia Eagles, winning a reputation as one of the greatest ends of all time. He was an all professional end with the Bears (1933-34) and Eagles (1936-37).

**HEWLETT, MAURICE**, 1861-1923, English novelist, was born in Addington. He was the author of a number of romantic historical novels, including *The Forest Lovers* (1898); *Richard Tea-and-Nay* (1900); *The Queen's Quair* (1904). He also published *The Song of the Plow* (1916), a satirical poem on the English farmer, and a number of volumes of short stories and essays, notably *Little Novels of Italy* (1899); *The New Canterbury Tales* (1901); *Wiltshire Essays* (1921); *Extemporary Essays* (1922).

**HEXAGON**, a closed geometric figure bounded by six straight lines that lie in one plane (see POLYGON). A regular hexagon has all its sides equal and also all its angles. When a regular hexagon is inscribed in a circle, each of its sides is equal in length to the radius of the circle, and the radii drawn to the



**Hexagon:** A, irregular; B, a regular hexagon inscribed in a circle; and C, a set of close-packed hexagons, approximately regular

six vertices of the hexagon divide it into six equilateral triangles. Equal regular hexagons, like equilateral triangles, or squares, may be placed on a plane so as to fill the space completely. The hexagonal form of bees' cells results naturally from the packing together of equal walled-in regions, with three walls meeting at a point.

**HEXAMETER**, the standard verse form in the Latin and Greek languages. It is a measure containing six feet, of which the final foot must be a spondee (two long syllables) or a trochee (a long and a short), the penultimate normally a dactyl (a long and two shorts), and the remaining four feet either dactyls or spondees at discretion. In this meter the great classical epic and philosophical poems were written—the *Iliad*, *Odyssey*, *Aeneid*, and Lucretius' *Natura De Rerum*; and in the hands of Virgil it became what Tennyson calls "the stateliest measure ever moulded by the lips of man." Efforts have been made, with varying success, to naturalize the hexameter in modern tongues, notably in English in the early Elizabethan times. Their chief product was the preposterous *Aeneid* of Richard Stanyhurst (1582). The next attempt was made in Germany by Klopstock, Goethe, and Schiller; and owing to the presence of quantity in German, it has proved successful. The measure has also been used with considerable success by the Swedish poet Runeberg in *Elgskytterne*, though with a large admixture of anapaests. Three modern English poets have also employed the hexameter—viz., Kingsley, in his *Andromeda*; Clough, in the *Bothie of Toberna-Vuolich*; and Longfellow, in *Evangeline*. These accept an accented syllable as equivalent to a classical long, and an unaccented as equivalent to a classical short. The objections to this form are briefly these. First, trochees must be accepted as equivalent to spondees. The trochee is a light, tripping foot; the spondee a slow, heavy one: the characteristic movement of the measure is therefore different from the classical. Secondly, in English, dactylic measures in time become anapaestic.

**HEXAPLA**, the name of a famous polyglot version of the Old Testament, edited by ORIGEN. The work is mostly in six parallel columns in which appear the text in Hebrew and Greek and the versions of AQUILA, Symmachus, Origen, and Theodotion. Only fragments of the work are extant.

**HEXATEUCH**, the first six books of the Old Testament. It is analogous to the term PENTATEUCH



(first used by ORIGEN), which refers to the first five books of the Bible. The word *Hexateuch* was used to indicate a similarity in origin and structure of the sixth book (Joshua) with the preceding five so-called "books of Moses." For a long time Moses was credited with the authorship, or at least the compilation, of the first five books of the Old Testament, and Joshua was considered the author of the sixth book, which bears his name. In the 17th century, however, biblical scholars began to realize that the internal evidence presented by the Pentateuch did not support the authorship of Moses or even that of a single writer. For the same reason, scholars began to doubt that Joshua was the author of the book bearing his name. For example, the accounts of the deaths of Moses (Deut. 34) and of Joshua (Josh. 24:29-30) could not have been written by themselves. The two stories of the CREATION (Gen. 1-2:4a and 2:4b-25) and other similar divergent accounts of the same events offer evidence against the single authorship of the Pentateuch.

Biblical research has revealed that the Pentateuch is largely based upon four major documents: (1) the Priestly Code (designated "P"), 450-250 B.C.; (2) the Deuteronomic Code ("D"), 621-350 B.C.; (3) the Elohist Code ("E"), 850-700 B.C.; and (4) the Jahwist Code ("J"), 900-500 B.C. These major documents are not in themselves literary units, but are, in turn, the bringing together of other codes, as for example, the Holiness Code ("H") in the Priestly Code, the "Book of the Covenant" ("C") in the Elohist Code, and the Kenite Code ("K") in the Jahwist Code. By comparing these documents with the material contained in Joshua, scholars came to the conclusion that the sixth book of the Bible formed a continuation of the documents J, D, and P, and possibly E as well. Thus the Hexateuch, which includes Joshua with the five books of Moses, constitutes a literary unit, since all six of the books depend upon the same documentary sources. Considered as a unit, the six books trace history of the Israelites up to the time of the fulfillment of God's promise, as it is recorded in the book of Joshua, when the Children of Israel enter the Promised Land. Originally, the six books were probably thought of as a literary unit, but, according to some scholars, some time in the fourth century B.C. Joshua was separated from the first five books of the Bible, perhaps in order to emphasize the importance of the law revealed to Moses, which represented the doctrines of orthodox Judaism. The Pentateuch is now generally considered to be less of a historical and literary unit than is the Hexateuch. See BIBLE; JOSHUA.

BIBLOG.—J. Hastings, ed., *Dictionary of the Bible* (ed. 1945).

**HEXOSE.** See CARBOHYDRATE.

**HEXYLRESORCINOL**, also called **Caprokol**, is a highly effective but somewhat irritating ANTISEPTIC. Hexylresorcinol is probably the most valuable ANTHELMINTIC (worm remedy). It apparently injures the cuticle of the parasitic worms, causing them to relax their hold on the intestinal wall. Military experience in World War II has shown that it should be the drug of choice in infestations of the intestine with the large roundworm (*Ascaris lumbricoides*), in mixed infections with ascaris and hookworm, and in intestinal fluke infections. It is the drug of second choice for the parasitic invasion of the intestines by the American and European hookworms, the whipworm, and the pinworm. It is only mildly effective in tapeworm infestations. See WORM REMEDIES.

The advantages of hexylresorcinol over other worm remedies are its low general toxicity, permitting repeated treatments, and the simplicity of its administration. It is given in hard gelatin capsules to the fasting patient without a preliminary purge, and two hours later epsom salts are given to remove the benumbed or dead worms, as well as the unabsorbed portion of the drug, from the intestine. Food is usually withheld for five hours after administration.

Hexylresorcinol is not suited for indiscriminate or self-medication, since its ingestion may cause irritation of the lining of the alimentary canal or in very large doses corrosion of the wall and even damage to the liver and heart.

Hexylresorcinol has been used as a local antiseptic in the form of *Solution of Hexylresorcinol S. T. 37*. The "S. T." stands for surface tension, signifying that at least some of the antiseptic properties of the drug are due to the low surface tension of the solution. But because many individuals are markedly intolerant to its local application, and because its effectiveness is diminished in the presence of organic matter, such employment is not particularly recommended. Hexylresorcinol when taken by mouth is in part absorbed and finally excreted in the urine, mostly in an inert form, but sufficient amounts of it are excreted unchanged so as to impart antiseptic qualities to the urine. It was very popular at one time in the treatment of various infections of the urinary tract, but the advent of the sulfa drugs and antibiotics rendered this use obsolete.

Hexylresorcinol ( $C_{12}H_{18}O_2$ ) is a pale yellow, heavy liquid, which becomes solid and crystalline at room temperature. It has a pungent odor and a sharp, astringent taste causing a sense of numbness when applied to the tongue. It is only sparingly soluble in water but freely soluble in alcohol, olive oil, and glycerin.

THEODORE KOPPANYI

**HEYDLER, JOHN ARNOLD**, 1870–, American baseball official, was born in Lafargeville, N.Y. He was president of the National League from 1918 to 1934.

**HEYMANS, CORNELIE**, 1892–, Belgian physiologist, was born in Ghent and studied at the University of Ghent where he became professor of pharmacology (1925). He also directed the university's Institute of Pharmacodynamics and Therapeutics founded by his father, J. Z. Heymans. His early research was concerned with the sensory mechanism in the vascular system which enables the arterial blood pressure to be kept under the control of the reflex nervous system. He also discovered about 1929 the sensitivity of the carotid sinus and sinus aorta to certain chemical changes in the blood; this sensitivity makes it possible to regulate respiration so that an adequate amount of oxygen will reach the heart and brain. His contributions were recognized with the award of the 1938 Nobel prize in physiology and medicine.

**HEYSE, PAUL JOHANN LUDWIG**, 1830-1914, German novelist and dramatist, was born in Berlin. He studied the classic and Romance languages at the University of Berlin, planning to become a teacher of philology, but the success of his short story, *L'Arrabbiata* (1855), led him to adopt a literary career. He settled in Munich and, writing under the patronage of Maximilian II (and later Ludwig II), produced some 120 short stories, six novels, 60 plays, and a large quantity of verse, including translations from Spanish, Italian, and English poets. His novels and plays were unsuccessful, but his graceful, romantic short stories, in which he expressed a refined, traditional idealism, made him one of the best known German writers of his generation. He was awarded the Nobel prize in 1910. Besides *L'Arrabbiata*, the best of his short stories are *Das Mädchen von Treppi* (1858), *Andrea Delfin* (1859), and *Der Weinhiuter von Meran* (1864).

HEYSHAM. See MORECAMBE AND HEYSHAM.

**HEYWARD, DU BOSE**, 1885-1940, American writer, was born in Charleston, S.C. Forced by poverty to leave school at an early age, he worked first as a newsboy and later as a checker in a cotton warehouse on the Charleston wharves, where he studied the character of the water-front Negroes and acquired much of the background material for his fiction. His first book, *Carolina Chansons* (1922), was a volume of poems written with Hervey Allen. *Porgy* (1925), his

first novel, was a brilliant, compassionate story of Carolina Negro life. It was dramatized by Heyward and his wife (1927) and was made into an opera by George Gershwin (*Porgy and Bess*, 1935). His other works, mainly concerned with Negro life, include *Mamba's Daughters* (1929), *Lost Morning* (1936), and *Star Spangled Virgin* (1939). Many of Heyward's readers received the impression that he was himself a Negro, a mistake which he considered a compliment to his efforts at sympathetic realism.

**HEYWOOD, JOHN**, 1497?-1580, English dramatist, was probably born in London. Having been introduced at court by Sir Thomas More, he became musician and provider of court entertainments to Henry VIII. The later years of his life were spent at Malines. His chief works are: *A Mery Play Between the Pardoner and the Frere* (1533); *A Mery Play Between Johan the Husbnde, Tyb the Wife, and Syr Jhan the Priest* (1533); *The Play of the Wether* (1533); *The Play of Love* (1533); *Of Gentylens and Nobylte*, a play (1535); *The Four P's*, a play (1545?); *The Spider and the Flie*, an allegorical poem (1556).

**HEYWOOD, THOMAS**, 1575?-1650, English dramatist, was born in Lincolnshire. He began to write for the stage in 1596, and in 1598 was an actor in Henslowe's company. He was the most prolific playwright of his time. He also wrote pageants, poems, lives, and *An Apology for Actors* (1612). *A Woman Killed with Kindness* (1603), his masterpiece, is one of the earliest and most touching examples of English domestic drama. *The English Traveller* and the episode of Jane Shore in *Edward IV* are other examples of his pathetic power. In quite a different vein are *The Fair Maid of the West* and *The Captives*, two breezy comedies of adventure.

**BIBLIOG.**—O. Cromwell, *Thomas Heywood: A Study in the Elizabethan Drama of Everyday Life* (1928); A. M. Clark, *Thomas Heywood: Playwright and Miscellanist* (1931).

**HEYWOOD**, municipal borough, England, Lancashire, nine miles N of Manchester. The town is in a coal mining region and has cotton manufactures, iron and brass foundries, saw and molding mills, machine shops, and railway coach building works. Pop. (1951) 25,193.

**HEZEKIAH**, king of Judah 726-697 B.C. (the first 11 years probably a regency), was the son and successor of Ahaz, and a contrast in every way to his weak and superstitious father. His intimacy with the prophet ISAIAH strengthened his native reforming zeal: he purged the land of idolatry, repaired the Temple, and reorganized and endowed the Levitical priesthood. He improved the position of Jerusalem as a stronghold, and wrested his country from the suzerainty of Assyria. Sennacherib thereafter twice invaded Judah; but although the first punitive expedition had a measure of success, the second resulted in the mysterious destruction of his army—an event commemorated by Byron in his *Hebrew Melodies*.

**HIALEAH**, city, SE Florida, in Dade County, served by the Florida East Coast and the Seaboard Air Line railroads, about five miles NW of Miami in the city's suburban area. Founded about 1920 and incorporated in 1925, Hialeah is the site of the famous Hialeah Park Race Track which was opened in 1931. Pop. (1950) 19,676.

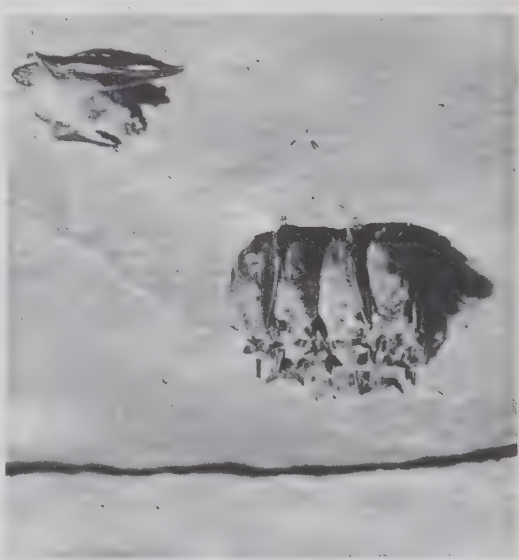
**HIAWATHA**, a legendary American Indian hero and peacemaker, immortalized in LONGFELLOW's long narrative poem, *The Song of Hiawatha* (1855). He was said to have been sent on earth to teach men the arts of peace and civilization. It was he who first gave maize to man for food, and who taught navigation and the science of healing. When the white man came, he ascended to the kingdom of Ponemah, the land of the hereafter. He was known as Hiawatha among the Iroquois, and among other tribes as Michabou, Chiabou, Manabozho, and Tarenawagon. Longfellow took the odd, trochaic meter of his poem from the Finnish epic, the *Kalevala*, from which he also borrowed several episodes. The detailed background

of primitive Indian life was constructed from his study of Henry Rowe Schoolcraft's *Algonic Researches* and from works on Indian anthropology by George Catlin and John Heckewelder.

**BIBLIOG.**—C. S. Osborn, *The Song of Hiawatha and Its Original Legends* (1947).

**HIBBING**, village, NE Minnesota, in St. Louis County, on the Duluth, Missabe, and Iron Range and the Great Northern railroads, and U.S. Highway 169; about 75 miles NW of Duluth. Hibbing, the center of the iron ore industry in the United States, is situated on the MESABI RANGE in the heart of the Arrowhead Lake region. It was laid out by Frank Hibbing in 1893. When ore was discovered on the site in 1919, the entire village was moved a mile south. The largest open pit iron mine in the world is located in Hibbing. Pop. (1950) 16,276.

**HIBERNATION**, or **WINTER SLEEP**, is a common phenomenon among animals. It appears to be one aspect of the general characteristic of animals to withdraw from an unfavorable environment. The



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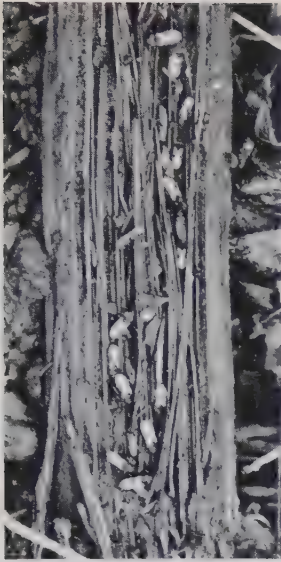
**Hibernating Bats use their claws to suspend themselves head downward from the roof of a cave**

phenomenon occurs most commonly among all cold-blooded animals that are unable to leave regions of severe winters. The animal passes the unfavorable period of low temperature and food scarcity in a torpid state.

Hibernation has been studied in such invertebrates as snails, crustaceans, myriapods, insects, and arachnids and in lower vertebrates such as reptiles, amphibians, and some fresh-water fishes. The animals remain buried throughout the winter with the body temperature approximately that of the external environment, and with a decrease in METABOLISM.

Hibernation has not been observed among birds but is found in many mammals that inhabit the colder latitudes, especially those species living in the ground or whose principal sources of food are unavailable in the winter. In a hibernating mammal, such as the bat, ground squirrel, marmot, hedgehog, or dormouse, the temperature of the body drops from its typical warm condition to one or a few degrees centigrade above that of the surrounding air. In maximum torpidity heart rate is slowed considerably, sometimes to only 1 to 2 per cent of the normal heart rate. The respiratory movements drop off to a similar extent and determinations of oxygen consumption indicate a reduction to as low as 3 to 5 per cent of normal consumption. In general, the time of the initiation of hibernation corresponds closely





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**Chinch Bugs** hibernate in a corn stalk (about actual size)

the body. The evidence at hand indicates that in such cases the body weight may drop by as much as 50 per cent. In other cases food is stored within the winter nest and the hibernating animal awakens from time to time to consume its food.

Hibernating mammals may be induced to awaken readily by strong external stimuli. Following awakening there is a gradual elevation of body temperature and a regaining of normal physiological activity and behavior. Lowering the temperature of the body to approximately 0° C. (32° F.) has also been reported to awaken hibernating mammals, though other investigators report that the animals can often be killed by freezing without awakening.

In several species of **BEAR**, only the female dens up in the winter, and appears to undergo a partial hibernation during which the young are born. The young cubs and the emaciated parent then emerge in the spring.

It has been claimed that certain Russian peasants of the Pskov region have been known to sleep round a fire during most of the winter, awakening once daily to eat. There is no evidence that this is anything other than a quasi-hibernation. Reports that certain Indian fakirs have been able to assume a lethargic state and survive burial for a year or more must be treated with skepticism.

FRANK A. BROWN, JR.

**HIBERNIA**, also **Ierne**, **Iverna**, or **Juverna**, the name by which Ireland was known to the ancient Romans.

**HIBERNIANS, ANCIENT ORDER OF.** See **FRATERNAL ORGANIZATION.**

**HIBISCUS**, a genus of plants (of which there are about 150 known species), mostly tropical or subtropical, belonging to the family *Malvaceae*. Most of the species bear attractive flowers, and many are cultivated. The rose of Sharon, *H. Syriacus*, is the most familiar cultivated species, and the swamp rose-mallow, *H. Moscheutos*, is common along the Atlantic Coast of the United States, and the region of the Great Lakes, generally in brackish marshes. This hibiscus is very handsome, tall, with great velvety, ovate leaves, and flaring, bell-shaped flowers, usually of a brilliant rose color. It is easily grown in well-watered gardens. The fruit of *H. esculentus*, commonly called gumbo or okra, is widely used as food in the United States and the East and West Indies. The leaves of *H. cannabinus* yield mucilage, the seeds yield oil, and the fiber is used in making Indian hemp.

with scarcity of food and lowering of environmental temperature. The termination coincides with the return of favorable conditions. However, some species, or some individuals, may commence the hibernating period while factors are still quite favorable, or may terminate the period at an unfavorable time. Modern theories of the mechanism stress the physiological sequence of events characteristic of the process. These events can apparently be set into activity by any one of several external stimuli.

During hibernation the mammal may not feed, depending entirely on the stored food reserves within

**HICCUPS** are due to spasmodic contractions of the diaphragm. The usual cause of hiccups is irritation to the nerves that control action of the diaphragm. This causes the diaphragm to contract spasmodically at more or less regular intervals. The kind of irritation which causes hiccups includes excessive hunger or, on the contrary, fullness of the stomach. Hiccups may also be caused by inflammations or other irritations in the upper abdomen, some of them of rather serious nature. Hiccups are frequently found in the terminal stages of cancer of the stomach, the liver, or the pancreas, in cirrhosis of the liver, and in other severe and fatal upper abdominal conditions. Ordinarily hiccups are not anything to worry about. Usually they are self-limited.

There are probably thousands of different "cures" for hiccups. Almost everyone has his own favorite, such as sipping water slowly, pulling on the tongue, being startled, or receiving a sudden stimulation by the application of ice water or some cold object to the skin. A sudden approach or speaking sharply to the individual is said to stop hiccups. Slapping has been recommended. Anything that will startle the person out of his routine is thought likely to have a favorable influence in controlling hiccups. The fact is that none of these remedies has any genuine significance because hiccups usually start for no apparent reason and terminate in the same way. It is only the extreme, intractable type of hiccup, which comes as a terminal factor in serious disease, that requires medical treatment. Long-continued hiccups can be extremely exhausting. When hiccups are the symptoms of severe disease, even their control is only a temporary expedient and the disease is not affected. Physicians in treating severe and intractable cases of hiccups may use sedative drugs or they may even resort to anesthesia as a means of breaking the automatic cycle of contractions to which the diaphragm has accustomed itself.

W. W. BAUER, M.D.

**HICHENS, ROBERT SMYTHE**, 1864-1950, English novelist, born in Speldhurst, studied at Clifton College and the Royal College of Music. Author of more than 50 books, short stories, and song lyrics, he succeeded G. B. Shaw as music critic of the *London World* after publication of his first success, *Green Carnation* (1894). He left England three years later to travel and write. In *The Garden of Allah* (1904) Hichens employed his favorite theme, the spiritual regeneration of an Englishman in the East. His other novels include *Bella Donna* (1909), *Dweller on the Threshold* (1911), *The Paradise Case* (1933), and *Too Much Love of Living* (1947).

**HICKOK, JAMES BUTLER**, called **Wild Bill**, 1837-76, American frontier scout and marshal, was born in Troy Grove, Ill. He went to Kansas shortly before the Civil War, and was a stagecoach driver first on the Santa Fe Trail and later on the Oregon Trail. During the Civil War he served as a Union scout, and afterward officiated as U.S. marshal of Hays City and Abilene, Kan., successively. He attained legendary stature for his feats of daring and his skill as a pistol marksman. He was shot in the back by gambler Jack McCall in Deadwood, Dakota Territory.

**HICKORY**, town, North Carolina, Catawba County, near the Catawba River, on the Southern and the Carolina and Northwestern railroads; about 58 miles W of Salisbury. Near by is a timber-growing region supplying wood for hickory wagons, which have been made here since 1880. Other industries include hosiery, cotton, and knitting mills, iron foundries, and garment and furniture factories. Hickory is the seat of Lenoir-Rhyne College. Pop. (1950) 14,755.

**HICKORY**, a genus of deciduous trees belonging to the Walnut family, *Juglandaceae*. These trees have clusters of fertile flowers and thick-husked fruits with bony nuts that ripen in autumn. One species, *Carya illinoensis*, the pecan tree, grows on river bottoms in the Middle West and South. It is a large tree that





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**Shagbark Hickory Tree** as it appears in summer, left. Above, thin-shelled nuts and leaves of the tree. Winter view of shagbark hickory, at the right, shows rough bark from which tree derives its name

bears delicious, olive-shaped nuts extensively used in candies and desserts. Shellbark or shagbark hickory, *C. ovata*, bears thin-shelled nuts, the hickory nuts of commerce. Bitter pecan trees, *C. aquatica*, grow in river swamps and bear compressed nuts, while the bitternut or swamp hickories, *C. cordiformis*, common in moist woods, have six-ridged fruits with a thin husk. The hickory genus is of considerable economic importance both for its edible nuts and the valuable timber obtained from the trees. The timber is used for wagon parts, handles, agricultural implements, and for other products in which shock-resistance and strength are required.

**HICKS, ELIAS**, 1748-1830, American Quaker minister, was born in Hempstead, N.Y. He began his leadership in the Society of Friends when about 27 years old. He traveled widely in the United States and Canada as a preacher during the next 50 years; denounced slavery, and was influential in having the New York legislature pass the act of July 4, 1827, freeing all slaves in the state. In 1817 he vigorously opposed the attempt to adopt an orthodox creed with a view to uniting with the English Friends, and thus became the head of a faction. His followers, termed Hicksites, outnumbered the others (see FRIENDS). He published *Observations on Slavery* (1811); a *Journal* (1828), and *Letters* (1834).

**HICKS, THOMAS HOLLIDAY**, 1798-1865, American legislator, was born in Dorchester County, Md. He was a member of the state legislature, governor (1858-62), and U.S. Senator (1863 till his death). His sympathies were with the South, but he opposed secession. He tried to keep Maryland neutral; but, finding that impossible, he defied the legislature, suspended the writ of habeas corpus, seized the arms belonging to the state when there were rumors of a plot to prevent the inauguration of Lincoln, and in other ways supported the position of the Federal administration. For this attitude the legislature afterward thanked him.

**HICKS, WILLIAM**, known as **Hicks Pasha**, 1830-83, Anglo-Egyptian general. He was staff officer in

the Ronhilkand expedition and served in the Abyssinian War (1867-68). In 1883 he was transferred to the Egyptian army and was placed in command against the MAHDI (1883). After defeating the enemy at Jebel Ain (April 29) he ascended the White Nile to Duem, and thence crossed the desert to El Obeid. Ambushed (Nov. 1) by the Mahdi in person, his Egyptians resisted bravely until the fourth day. Only the rear guard escaped.

**HIDALGO**, state, Mexico, bounded on the W and NW by the state of Querétaro; on the N by San Luis Potosí; on the E by Veracruz; on the S by Mexico and Tlaxcala; area 8,058 sq. mi.; pop. (1950) 840,760. It is crossed in the north and northwest by the Sierra Madre. This part of the state is wild and mountainous, the highest point reaching 10,528 feet. The south and west, however, are comparatively flat, and contain many fertile valleys. The state is drained by the Tula, Amajagué, and Grande rivers, with their tributaries. The principal lake, Metzctlan, is 10½ miles in length. There are many mineral springs. The chief industries are stock raising and mining; almost every district is a mining center. Silver, gold, platinum, copper, iron, zinc, lead, antimony, manganese, and mercury are worked. The chief agricultural products are cereal crops, coffee, tobacco, fruits, peppers, maguey (from which pulque is made), and sugar cane. There are manufactures of cotton and woolen goods, bricks, tiles, and native wares for local use. Several railroads cross the state. The capital is Pachuca.

**HIDALGO DEL PARRAL** See PARRAL.

**HIDALGO Y COSTILLA, MIGUEL**, called the **Father of Mexican Independence**, 1753-1811, Mexican revolutionist, priest, and national hero. A Creole, i.e., the son of parents both of whom were of pure Spanish stock but were born in Mexico, Hidalgo was born on the hacienda of San Diego Corralejo in what is now the state of Guanajuato. At 14 he entered the Jesuit-founded College of San Nicolas Obispo at Valladolid, and between 1770 and 1773 he earned degrees in liberal arts and in sacred theology at the University of Mexico. After his ordination and a series

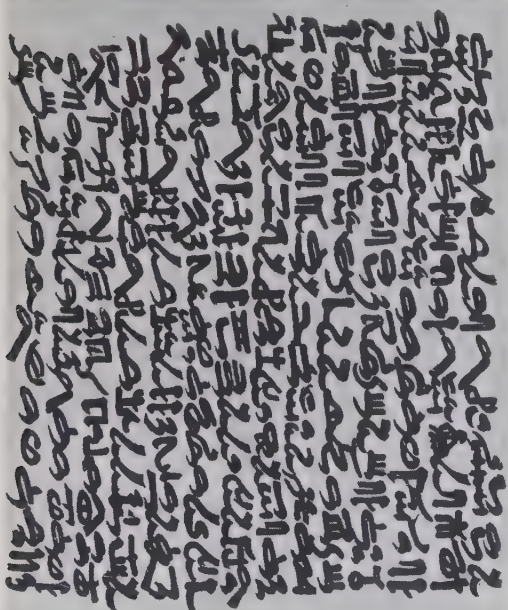




measure to the fact that conventional modifications of the hieroglyphic writing proper were used for business and literary purposes. The oldest Egyptian cursive writing is known as the *hieratic*; a later modification of that is called *demotic*.

The modern decipherment of the Egyptian hieroglyphics was suggested and rendered possible by the discovery, in 1799, of the **ROSETTA STONE**, by one of the officers of Napoleon the Great. This stone contains a trilingual inscription, written in hieroglyphics, in the demotic character, and in Greek letters. The first important attempt at decipherment was made by an English physician and scientist, Dr. Thomas Young. But the credit of laying the foundations of our present knowledge of the Egyptian language and literature belongs chiefly to the French scholar **FRANCOIS CHAMPELLION**.

The Egyptian hieroglyphic system is by no means of a simple or primitive character. It is indeed partly ideographic. The representation of the sun stands not only for the sun itself, but also for the word "day." The figure of a man in the attitude of prayer expresses the concept of worship. Side by side with such primary symbols are combinations of simple picture signs, used to express conceptions too complicated for representation by a simple character. For the most part, however, the hieroglyphic signs are not ideographic or expressive of words; they are phonetic—i.e., they express sounds, both syllables and simple sounds. Certain picture signs which originally denoted words came to denote merely the first letters of these words. In fact, the Egyptians continued to use, side by side, intermixed with one another, three kinds of characters—ideographic, syllabic, and alphabetic. The old word signs or ideograms were retained chiefly as "determinatives." A word which is spelled in alphabetic or syllabic characters may be followed by an ideogram representative of the same word. There are also generic determinatives, used to denote the class of the words that they follow—as, for example, a royal or a divine name, or an action of a particular kind. Ambiguous words also are defined by means of determinatives. In fact, ideograms are seldom used independently of the simpler and more definite phonetic spelling which was in general use.



**Hieratic Writing**, oldest Egyptian cursive form, was used in *Prisse Papyrus*, written about 2500 B.C.

**Cuneiform.** It is now certain that the **CUNEIFORM** signs of the Sumerian, Akkadian (or Babylonian), and Assyrian syllabaries had pictographic antecedents in Sumerian writing of the Proto-Literate period (see **MESOPOTAMIA**). The developed cuneiform characters are partly ideographic and partly syllabic; some of them represent words and some represent syllables. The employment of ideograms as determinatives is a feature of cuneiform writing also. The peculiar wedge-shaped appearance of every stroke in the ordinary characters is due to their having been printed on clay tablets with an instrument of a certain shape. In the oldest documents the signs were not made with a wedge-shaped stylus but with various tools giving straight lines, circles, dots, etc. The developed systems contained more than 400 signs which were in general use. A considerable number of languages came to be written in cuneiform; besides the original Sumerian, Babylonian, Assyrian, Mitannian, Hurrian, Ugaritic, Persian, etc. In Ugaritic (c. 1500 B.C.) as in the much later Persian, the cuneiform signs had an essentially alphabetic use.

**Chinese Writing** has an independent history curiously parallel, in some respects, to these other systems. The forms of certain of the signs in their earliest known shape make it clear that they were originally pictorial. The Chinese themselves distinguish a large number of such signs. Probably, at first, there were only a limited number, which has been largely increased by combinations of the primitive symbols; for many word signs have been borrowed from other words related to them in meaning. Chinese also supplies an example of the transition from a pure ideographic system to a mixed system in which phonetic characters are employed. These phonetic characters, denoting sounds, are by far the most numerous in Chinese writing. The language is now rich, however, in words which are pronounced similarly, though with different "tones," and which are quite different in meaning. The phonetic spelling of a word, therefore, does not sufficiently determine its meaning. This difficulty has particularly favored the use of determinatives. They are 214 in number, and denote the class to which a word belongs. The determinative is combined in writing with the phonetic character so as to form a compound sign. Thus every word has practically a special sign of its own, and the total number of separate characters in the language is enormous. The Chinese system of writing is perhaps the most cumbrous that has ever existed.

**Other Hieroglyphics.** Under the writings commonly called hieroglyphic are the Hittite rock-cut inscriptions of Asia Minor and Syria, and the clay-impressed scripts of Minoan Crete and of Pylos on the Greek mainland. Considerable progress has been made in the decipherment of Hittite (see **HITTITES**). The work on the Minoan type inscriptions proceeds more slowly. Another great series of hieroglyphic systems—sometimes stone-cut, sometimes painted in what seem clearly to be books—are those of Middle America. The invention of writing in this area is considered to have been a Mayan achievement. The Aztec, Mixtec, etc. documents are in variant styles of script based on a borrowing of the general idea of writing from the Maya. About half of the signs in Maya writing are now understood. They are of a numerical astronomical nature. See **PICTURE WRITING**; **WRITING**.

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**HIERRO ISLAND**, or **Ferro**, smallest of the Canary Islands; area 107 sq. mi.; pop. (1940) 8,849. The island is of volcanic origin, with mountains reaching 4,925 feet. About 1,400 acres are wooded, and large areas are given over to pasturage for mules, sheep, cattle, and goats. The island produces apples,



quinces, plums, and chestnuts and is especially noted for its almonds, figs, and wine. The capital is Valverde (pop. 1,680). Because the island was in early times the most westerly of known lands, its meridian was used as the first meridian. The true longitude of Hierro, however, does not coincide with that assigned according to the "Longitude of Ferro."

**HIGDEN, RANULF**, d. 1364, English chronicler, was born in the west of England. He became a Benedictine monk at Chester, and was the author of the *Polychronicon*, which gives the history of the world from the Creation to the time of Christ, and the history of England up to 1342. It has been edited, with English translation, by Babington and Lumby, in the Rolls Series.

**HIGGINSON, HENRY LEE**, 1834-1919, American banker and philanthropist, was born in New York City and studied at Harvard College. After service with the Federal forces during the Civil War he entered the Boston banking firm of Lee, Higginson and Company (1868). He founded the Boston Symphony Orchestra in 1881 and financed it over a period of 37 years. He was also a benefactor of his alma mater to which he gave land for Soldiers' Field and the Harvard Union building.

**HIGGINSON, THOMAS WENTWORTH**, 1823-1911, American writer, was born in Cambridge, Mass., and was educated at Harvard. He entered the Unitarian ministry, and held pastorates at Newburyport (1847-50) and Worcester (1852-58), combining his preaching with ardent agitation against slavery. He aided fugitive slaves, supported the Free-State movement in Kansas, and was colonel of the first Negro regiment during the Civil War. After the war he wrote and lectured on suffrage, and published a number of volumes of memoirs, notably *Army Life in a Black Regiment* (1870), *Oldport Days* (1873), *Cheerful Yesterdays* (1898), *Contemporaries* (1899), and *Part of a Man's Life* (1905). Other works include literary essays, as *Short Studies of American Authors* (1879), and biographies of Margaret Fuller (1884), Longfellow (1903), and Whittier (1903). He is now remembered principally as a memorialist of the New England literary patriarchs of whom he was almost the last survivor, and as the discoverer of the genius of EMILY DICKINSON, whose poems were first published under his editorship (1890-91).

**HIGH COURT OF JUSTICE**, one of the great divisions of the Supreme Court of Judicature in England. See COURT.

**HIGH EXPLOSIVE**. See EXPLOSIVE.

**HIGH POINT**, city, central North Carolina, in Guilford County, on the Southern, the High Point, Randleman, Asheboro, and Southern, and the High Point, Thomasville, and Denton railroads; U.S. highways 29, 70, and 311; and the Eastern and the Pennsylvania-Central air lines; 17 miles SW of Greensboro; High Point is an industrial city located on a level plateau in the Piedmont Region. It was laid out in 1853 and derived its name from its position as the highest point on the railroad between Goldsboro and Charlotte. The High Point College is located here. High Point is the southern center of two major industries, the making of furniture and hosiery. Pop. (1950) 39,973.

**HIGH POINT COLLEGE**. See COLLEGES.

**HIGH PRESSURE AREA**. See ANTICYCLONE; COLD WAVE; WEATHER; METEOROLOGY.

**HIGH PRIEST**, the head of the Israelite priesthood. According to biblical tradition, the first high priest was AARON, who was succeeded by his son Eleazar, from whose line the later holders of the dignity were required to be taken. The high priest was distinguished from the ordinary priests by his elaborate and costly robes, together with the ephod and the breastplate, the receptacle of the Urim and Thummim. His special prerogative was to enter the Holy of Holies on the Day of Atonement, in order to make propitiation for the people, the sanctuary, the

priests, and himself. He was under more stringent rules regarding purity than his inferior brethren: for example, he was permitted only to marry a virgin; he was prohibited from touching a corpse, even that of his father or mother, and from manifesting the customary signs of mourning.

In the New Testament, "high priest" and "chief priest" represent the same Greek word *archiereus*; the latter (always in the plural), however, presumably embraces both the high priest then in office and such of his predecessors as were still alive. See JUDAISM; ATONEMENT, DAY OF.

**HIGH SCHOOL**, the most common American institution devoted to secondary education. Nearly every city, town, or large village has one, and larger cities have two or more. Authority to operate a high school is delegated by the state government to a locally elected board of education, and in most places both elementary and secondary schools are under the same board. The chief administrative officer of a high school is called the principal, who may be assisted by deans, a registrar, and department heads.

High schools, except for those conducted by the Roman Catholic Church, are nearly always co-educational. In enrollment they range from less than a hundred students to seven or eight thousand or more. Consolidated or community high schools have replaced many smaller ones. Schools with an enrollment of 800 or less offer the advantage of solidarity and mutual acquaintance, while those with an enrollment of 2,000 or more are able to provide a greater variety of subjects and numerous supplementary activities.

High school buildings range from old, boxlike structures to elaborate, modern constructions with the latest lighting and air conditioning. An auditorium accommodating all the students and faculty in assembly and usable for community meetings is an almost indispensable feature. A gymnasium is almost always included to provide facilities for the physical education required by law. Most high schools have their own athletic fields, and many also have swimming pools and stadiums. The library may be one small room or a major wing of the building. Large study halls house students when they are not in classrooms or on the playing fields. The tendency is to provide pleasing decoration and modern lighting in classrooms and laboratories.

Instruction in high schools is departmentalized, and in the larger schools various groupings according to ability or interest are possible. Both college preparatory and terminal educational aims govern the choice of subjects and methods. The range of subjects offered in the curriculum usually reflects the interests and occupations of the people in the area served by the school. Larger cities provide separate technical or vocational schools. Evening high schools usually use the facilities of the day schools.

Personnel work or guidance is an important part of the high school program. This is usually carried on by organizing small home room or adviser groups under teachers who acquaint themselves with each student's individuality through interviews and calls at the home. In many schools, deans and other administrative officers promote such work.

Extracurricular activities, far from being an appendage, are an integral part of the program. In fact, a persistent problem for the administrators is to keep the proper balance between these and the curricular activities. See SECONDARY EDUCATION; EDUCATION IN THE UNITED STATES, Organization.

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**HIGH SEAS**, the open ocean beyond the jurisdiction of any state, as contrasted with territorial waters. Traditionally the high seas begin at the three-mile limit; this rule has been generally followed since the early part of the 18th century as a result of the suggestion made by Bynkershoek, the Dutch writer on international law, that the jurisdiction of

each maritime state should extend as far as cannon fire could reach. Since cannon then could fire about three miles this rule became established. Territorial waters, however, include not only seas within the three-mile limits but also inland waters, gulfs, and many large arms of the sea (in many cases because of immemorial usage). The Supreme Court of the United States has held that the term "high seas" applies to the open waters of the Great Lakes; Lake Michigan, however, constitutes territorial waters since it is entirely enclosed by American territory. Because of the much longer fire-power of present-day guns and also because of the wide range of air power suggestions have been made in recent years to extend territorial waters, but no agreement has ever been reached on this point. Usage may in time extend the limit. See **SEARCH, RIGHT OF**.

**HIGH TENSION CURRENT**, in electrical engineering, a current of electricity high in voltage, generally in excess of 650 volts. See **ELECTRONICS; POWER TRANSMISSION, ELECTRICAL**.

**HIGHER EDUCATION IN THE UNITED STATES.** Education above the secondary level both in junior colleges and in the colleges and universities granting the baccalaureate and advanced degrees is considered as higher learning. There are several reasons for this. Colleges normally admit persons beyond the age for compulsory school attendance and, on the whole, may use a selective method in choosing their students, thus restricting enrollments to the ablest of the secondary school graduates. College work presumes that elementary and secondary instruction have provided the common learnings necessary for meaningful participation in community life. It takes as its responsibility the development of an understanding of society, the arts, and the sciences, which is the sign of a fully educated person.

Within institutions of higher education one can find training for all the professions and work leading to the highest academic degrees. Research programs carried out within colleges and universities lead to discoveries in all areas of human activity. Ideally the higher institution is a community of intelligent and mature people who can discipline themselves and are assembled because of their desire to learn. The bulk of higher education is carried out in the four year colleges and the graduate and professional schools of the universities.

The oldest institution in the United States granting

the baccalaureate degree is Harvard, founded in 1636. The first colleges established in this country were patterned after English and other European universities, sharing with them strong ties to both church and state. Only men were admitted and their work was largely restricted to the study of Greek, Latin, and Hebrew literature. Elements which were later to become distinctive in American higher learning were gradually added to the curriculum.

By the close of the eighteenth century instruction in history, modern languages, and physical and biological sciences was given in some form at most of the larger institutions. Many colleges had been established by 1800 and several of the largest American universities were established as colleges before the Revolution: Yale, 1701, Princeton, 1746, University of Pennsylvania, 1740, chartered as a college, 1755, Columbia (as King's College), 1754, Brown, 1764, Rutgers, 1766, and Dartmouth, 1769. State universities, an essential feature of higher education in the United States, began with the establishment of the University of Georgia in 1785. The following hundred years saw the founding of many state universities, colleges, and teacher training institutions throughout the nation. With the rise of these higher institutions the ties between various private universities and the state grew weaker and eventually disappeared. In a similar manner the union of the church with certain higher institutions was gradually severed, and, with the exception of those schools which remained frankly denominational, American private universities and colleges became as secular in their nature as the state institutions.

#### COLLEGE COURSES FOR WOMEN

The education of women prior to the early nineteenth century commonly ended with the essentially secondary schooling provided by seminaries and academies. Mount Holyoke, founded in 1837, was one of the earliest collegiate type schools for women. Vassar, 1861, Smith, 1871, and Bryn Mawr, 1880, were providing women with a college course similar to that open to men, while Oberlin College was the first to admit women to classes with men students. The first degrees granted to women from a coeducational school were given at Oberlin in 1841. Although after 1850 women were often admitted to the universities in separate colleges, some of which are still in operation, by 1900 most of the state and private



Harvard College, an early etching by Paul Revere. All these buildings are still in use

HARVARD UNIVERSITY



## Higher Education

institutions which had set up "female colleges" within the university structure abandoned them for complete coeducation. Even so, in most schools admitting men and women the women students were in 1948 still required to observe strict regulations in regard to housing, hours, and other matters in which men have traditionally been given considerable freedom. Nevertheless, the triumph of coeducation in less than a hundred years is not to be denied. With few exceptions (outstanding among them, Princeton) all the large universities and professional schools are open to women in some or all divisions.

### TRAINING FOR PROFESSIONS

Higher educational institutions began instruction for the professions early in the nineteenth century. In a sense, training for the ministry, medicine, and law had always been a part of the university curriculum, although it was not uncommon for one to "read with a lawyer" rather than take formal instruction in law. This union of a successful professional career and service as a faculty member of a professional school is still encouraged by many educators. Indeed, fifty per cent of the professors of medicine, law, engineering, and journalism in certain schools have outside professional careers in addition to their work as teachers. The state universities added to the professional curriculum work in scientific agricultural methods and veterinary medicine. With increased enrollments of women students, courses in home economics, diet, and the care of children were added to the curriculum in both state and private colleges.

Always an important task of the higher institutions, specialized work for the training of elementary and secondary school teachers became a regular part of the university curriculum by 1900.

**Graduate Study** has been available in the United States since the seventeenth century when HARVARD began offering the M.A. degree to qualified students. However, the important growth of schools for graduate study took place in the final years of the nineteenth century. The first formal graduate school in the United States was opened at JOHNS HOPKINS UNIVERSITY in 1876, but several other universities had been granting graduate degrees prior to this time. The Association of American Universities, an organization to promote co-operation and uniformity of standards in the leading graduate schools of the country, numbered 37 higher institutions in 1950. Outstanding graduate schools were to be found in more than half of the states and in Canada. See CHICAGO, UNIVERSITY OF.

### CHANGES SINCE 1930

After 1930 a division of thought among educators resulted in major changes in the higher educational system, especially the liberal arts colleges. In the preceding twenty years the professional schools which now form such an important part of the modern university had developed in response to a definite demand on the part of students. They demanded that their higher educational courses provide them with knowledge and skills which would help them in obtaining employment and a satisfactory income. The old course in the classics was not "practical" for those who lacked wealth or were not interested in careers as scholars, teachers, or ministers. Certainly the classical education was not suited to the increased numbers of students attending state supported and private institutions of higher learning. In 1910, 335,215 persons were enrolled in higher institutions of learning. By 1920 the number was 597,880; by 1940, it had more than doubled, reaching 1,494,203. Following World War II, university and college enrollments in the United States reached record highs due to the influx of veterans studying under the G.I. BILL OF RIGHTS. Resident enrollments at colleges and universities in 1948 totaled 2,616,262. The total number of students entering college



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### Placement tests at the University of Chicago

for the first time in 1948 was 569,000. This figure dropped slightly in 1949, but total enrollments remained high. At the beginning of the 1950-51 scholastic year, colleges and universities reported a drop of 10 per cent in the number of students over the previous year, indicating that large numbers of the veterans training under the G.I. Bill had by then completed their educations.

The wide range offered in the professional schools, plus the spread of the elective system adopted by Harvard, permitted ever increasing numbers of students to acquire skills for their careers and, at the same time, receive liberal educations. "The Chicago Plan" of ROBERT MAYNARD HUTCHINS at the University of Chicago, the new curriculum of the college of COLUMBIA UNIVERSITY, and the Harvard Report, *General Education in a Free Society* (1946), all pointed to the need of basic education in the humanities, arts, and sciences. Under "The Chicago Plan" students are admitted to college two years earlier than usual and can complete a liberal course of study before their professional education begins. "The Plan" also calls for making certain liberal arts courses required in all undergraduate programs. In 1951 Johns Hopkins University instituted a similar plan when it obliterated distinctions between graduate and undergraduate students.

### UNIVERSITY EXTENSION COURSES

Higher education, however, is no longer restricted to full-time study. University extension courses, evening, "university college" work in urban areas, and the programs of public lectures and educational activities such as the "Great Books" movement are examples of the way in which many universities reach many persons who normally would never become candidates for academic degrees. Similarly the research programs carried out in universities by the Federal government, the Rockefeller Foundation, the Rockefeller Institute for Medical Research, the various Carnegie endowments, the Russell Sage Foundation, and the Guggenheim Foundation have influenced the lives of most Americans in one way or another.

### FINANCING HIGHER EDUCATION

In 1948 there were approximately 1,800 institutions of higher education granting degrees in the United States. These institutions that year granted more than 271,000 degrees at the baccalaureate level, in addition to conferring some 42,000 masters' and 4,000 doctoral degrees.

In 1948 these institutions had an income of slightly less than 2,000,000,000 dollars and expenditures of 1,400,574,000 dollars. The main sources of income were Federal and state governmental grants and student fees. Of the expenditures, nearly half went for

resident instruction, with the next highest outlay going for physical plant operation. The total value of property owned by these institutions in the United States was \$3,996,000,000 in 1948, and endowment funds held by them totaled altogether more than \$2,300,000,000.

Institutions of higher learning in the United States have several main sources of income, in addition to the Federal and state grants and student fees, referred to above.

In 1948, the Federal, state, and local governments spent the following for the support of institutions of higher learning: Federal, \$528,000,000; state, \$357,000,000; and local, \$47,000,000. Among other income of U.S. universities and colleges that year were: private gifts and grants, \$91,568,000; endowment earnings, \$86,708,000; student fees, \$305,632,000; sales and services of organized activities, \$93,024,000; and auxiliary enterprises and activities, \$466,667,000.

While the income of universities and colleges in the United States has increased (\$580,000,000 in 1938 and nearly \$2,000,000,000 in 1948), expenditures have likewise increased. The 1,690 institutions of higher learning reported in 1938 spent over \$475,000,000 that year. The 1,788 schools reported in 1948 made total expenditures exceeding \$1,400,000,000.

### JUNIOR COLLEGES

Although the baccalaureate still represents a greater than average attainment in education, more students are obtaining collegiate level instruction in 1947 than ever before. An important factor in this situation is the growth of the junior colleges: from 8 in 1900 with an enrollment of 100, to 634 in 1951 with a total enrollment of 562,786. California had the largest enrollment and the greatest number of colleges, 78. Illinois, New York, and Texas were also leading states, and together with California had a combined enrollment of 60 per cent of the total.

Originally, junior colleges were intended to provide two years of collegiate work in the student's home community as preparation for entering a four-year college on the upper-class level. Actually, many students of junior colleges never go on to receive their degrees. This is largely for economic reasons. Publicly supported junior colleges charge negligible tuition fees and the students usually live at home, thus reducing to the minimum the two main expenses involved in going to college. Students who attend private junior colleges usually can afford to go on to another school, but for the rest, the junior college must provide terminal education. See JUNIOR COLLEGE.

**G.I. Bill of Rights.** The G.I. BILL OF RIGHTS by giving financial aid to former service men and women who enrolled in colleges, resulted in the flooding of the higher educational institutions with persons qualified to attend college but whose educations had been interrupted by military service, or, who had hitherto been unable to attend college because of lack of funds. See EDUCATION IN THE UNITED STATES; COLLEGES; UNIVERSITY.

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**HIGHGATE**, a suburb of London, England, four miles NW of St. Paul's on the Great North Road. Its name dates from the 14th century toll gate erected by the Bishop of London. Among the interesting old buildings are Cromwell House; Lauderdale House, associated with Nell Gwynn; and the Whittington almshouses. Waterlow is one of London's most beautiful municipal parks. In Highgate Cemetery are buried Herbert Spencer, Karl Marx, Michael Faraday, and George Eliot. Whittington's Stone, at the foot of Highgate Hill, marks the spot where Dick WHITTINGTON heard Bow Bells chiming to "Turn

again, Whittington, thrice Mayor of London." See LONDON.

**HIGHHOLE.** See FLICKER.

**HIGHLAND**, town, NW Indiana, Lake County, on U.S. Highway 6, about 5 miles SW of Gary. It is a Dutch settlement in the center of a truck gardening community. Southwest of the town are sand dunes that were once beaches of Lake Michigan, whose shores are now seven miles away. Pop. (1950) 5,878.

**HIGHLAND**, a geographical term used to indicate areas of local relief and to distinguish rugged lands from relatively flat lands. The term has no absolute height boundaries. When highland is used to indicate relief, the usual division taken is at 500 feet: lowlands, below 500 feet; hill lands, 500 to 2,000 feet; mountains, above 2,000 feet. When the term is used to indicate ruggedness, mountains of denudation are usually being differentiated from tablelands and tectonic mountains. In this class are such highlands as the Appalachian and Laurentian uplands of North America, those of Greenland, those of northwest Europe from Brittany to Poland across central Europe, the Urals, and the extreme south of South Africa. In all cases the application of the term depends upon the local situation. Thus the Great Plains of North America, averaging 5,000 feet above sea level, are highlands when compared with the central lowlands bordering on the east, and lowlands when compared with the Rocky Mountains bordering on the west.

**HIGHLAND FLING**, a national dance of Scotland, generally danced by one person. The music is usually highly syncopated. The name is derived from the action of the dancer, who dances alternately on each leg, flinging the other out before or behind.

**HIGHLAND PARK**, city, NE Illinois, Lake County, on Lake Michigan, and the Chicago and North Western Railroad, 23 miles N of Chicago of which it is a residential suburb. Highland Park, situated on the site of two Potawatomi villages, was first settled by white men in 1834. Ravinia Park, a summer music center, is located here. Pop. (1950) 16,808.

**HIGHLAND PARK**, city, SE Michigan, in Wayne County, on the Pennsylvania, the Grand Trunk, and the Detroit Terminal railroads. Highland Park is entirely surrounded by Detroit of which it is a residential and industrial suburb. The first known settler here was a farmer of English descent, Richard Ford, who built his cabin upon the highland for which the city is named. Automobiles, automobile parts, and heating equipment are made in Highland Park. Pop. (1950) 46,393.

**HIGHLAND PARK**, borough, E central New Jersey, Middlesex County; on the NE bank of the Raritan River opposite New Brunswick of which it is a residential suburb. Pop. (1950) 9,721.

**HIGHLAND PARK**, town, NE Texas, in Dallas County, on the Missouri-Kansas-Texas Railroad. It is a residential suburb of Dallas, which it adjoins on the north. Pop. (1950) 11,405.

**HIGHLAND REGIMENTS**, Scottish regiments of the British army whose uniform is the Highland dress with a kilt of the distinctive tartan. The regimental bands are characterized by bagpipes and drums. Although assigned to Highland districts, they have not been exclusively recruited and officered in those districts in recent times. The oldest is the Black Watch (42d, Royal Highlanders, organized 1704).

**HIGHLANDS**, a region in the N and NW of Scotland. It has no political or civil boundary, but in general includes the territory lying north of a line drawn from Nairn, on the Moray Firth, to Dumbarton on the Clyde, as well as certain parts of the counties of Banff, Moray, Aberdeen, Kincardine, and Perth. See SCOTLAND.

**HIGHLANDS OF THE HUDSON**, a ridge of the APPALACHIAN MOUNTAINS, New York, lying mainly in Putnam, Orange, and Dutchess counties. Geologically, it is a continuation of the Blue Ridge of Penn-



sylvania, and is of very old formation. The general trend is northeast and southwest. It rises in imposing and picturesque elevations on both sides of the Hudson River. West Point (1,500 ft.) and Storm King (1,389) on the west bank, and Breakneck (1,635) and Anthonys Nose (1,048) on the east, are among the best known of these.

**HIGHMORE, ANTRUM OF.** See **SINUS.**

**HIGHWAY.** See **ROADS AND HIGHWAYS.**

**HIGHWAYMAN,** a bandit who preyed on the travelers of England's highways during the 17th, 18th, and 19th centuries. The highwaymen were excellent horsemen and often were dressed as gentlemen to escape detection. It was partly the picturesqueness of their costume as well as the danger of their trade which caused a romantic aura to grow about them, and as a result they have been celebrated in art and literature. W. F. Frith, depicted one of them, Claude Duval (1643-70) in a gallant pose in a painting, and Alfred Noyes wrote of them in his famous ballad, "The Highwayman." Like brigands (see **BRIGANDAGE**), the highwaymen flourished in times of economic and political unrest when there was a minimum of legal authority. For the same reasons they also flourished in the United States in frontier days, but rather than highwaymen they were called outlaws. See **OUTLAW.**

**HIJUMAA.** See **KHIUMA.**

**HIKONE,** city, Japan, Honshu, Shiga Prefecture, on the E shore of Lake Biwa, 40 miles by rail WNW of NAGOYA and 60 miles by rail NE of OSAKA, on the Tokaido trunk railroad. On a near-by hill is a good example of a feudal castle. Pop. (1946) 43,437.

**HILARION, SAINT,** c. 290-c. 371, hermit considered to be the founder of anchoritism in Palestine, born (according to Jerome) in Tabatha. He was educated in Alexandria and converted to monasticism by St. Anthony of Thebes, with whom he lived for a time in Egypt. Later he lived as a hermit in the desert between Gaza and Egypt and attracted so many followers that he was forced to leave Palestine in 360 and seek seclusion elsewhere. He died in Cyprus, and his feast day is October 21.

**HILARIUS, SAINT.** See **POPE.**

**HILARY, SAINT,** 320?-368, bishop of Poitiers, France, where he was born. Although reared in paganism, he was converted to Christianity about 350 and was chosen bishop of Poitiers, where he opposed the introduction of Arianism (see **ARIUS**) into Gaul. Because of his stand against the banishment of St. Athanasius, he was exiled to Phrygia (356), where he traveled among the churches of Asia Minor and defended the church against the attacks of the Arians at the Synod of Seleucia (359). In 361 he was returned to Gaul, where he continued his opposition to Arianism. He has been called the "Athanasius of the West" and was declared a Doctor of the Church by Pius IX in 1851. His English feast day is January 13, and is known as Hilarymas, but, since this date conflicts with the important octave day of Epiphany, the Roman Catholic Church observes his feast January 14.

**HILARY, SAINT, OF ARLES,** c. 401-449, was born in southern Gaul. He entered the monastery of Lerins, but was recalled to assist the bishop of Arles, and became his successor (427). As metropolitan of Arles (*Arelate*) he presided at several synods, and especially at Orange in 441, the proceedings of which involved him in a controversy with Pope Leo the Great. A deposed bishop, named Chelidonius, having carried an appeal to Rome, a council was summoned by Leo, at which the condemnation of Chelidonius, as well as that of another bishop, Projectus, was reversed. Hilary refused to submit to the decision, and quitted Rome. In the end he sought a reconciliation with Pope Leo. His feast day is May 5.

**HILDA, SAINT,** 614-80, abbess of Whitby, England, was daughter of Hereric, a nephew of Edwin of Northumbria, and was baptized at 14 by Paulinus.

Recalled by Bishop Aidan from a French monastery, she became abbess of Heorta or Hartlepool in 649. In 657 she founded the monastery at Streonshalh or Whitby, a double house for nuns and monks, over which she ruled for 22 years, dying in 680. Bede tells us that CAEDMON was a servant in the monastery.

**HILDEBRAND.** See **GREGORY VII.**

**HILDEGARD, SAINT,** 1098-1179, German Benedictine mystic, born in Böckelheim. She was reared on the river Nahe in the nunnery of Disibodenberg, of which she later became abbess. Some time before 1150 she went to the Rupertsberg, near Bingen, where, with a small group of followers who had accompanied her, she founded a convent and became its abbess. She became famous for her prophecies and her visions, which she had begun to receive in childhood but which she was afraid to reveal until she was middle-aged, when she set down in writing many of her visions. They became so widely known that people came to her for counsel on all sorts of subjects, including medicine. She corresponded with many of the religious notables of her time, including BERNARD of CLAIRVAUX and four popes, and also with the emperors Conrad III and Frederick I. Many of her letters are extant. Her principal writing is *Scivias* (1141-50), an account of her visions. Her name is included in the Roman Catholic martyrology although she was never canonized.

**HILDESHEIM,** town, Germany, in the Prussian province of Hanover, on the Innerste River, near the Harz Mountains, 20 miles by rail SE of the city of Hanover. Hildesheim was founded as a bishop's see by Charlemagne in 822. In 1241 the town became a member of the HANSEATIC LEAGUE. During the 15th and 16th centuries it was famous for its goldsmith work. On the Galgenberg, a hill east of the town, a treasure trove of Roman silver work was discovered in 1868 and later transferred to a museum in Berlin.

After World War II Hildesheim was left in ruins. Some of its outstanding historic features destroyed in the war were the *Knochenhauer Amthaus* built in 1529 as the guildhouse of the powerful Butchers' Guild, St. Michael's church, the most important monument of early Romanesque in Germany, the *Altstaedter Markt* with its Roland Fountain, one of the most picturesque squares in Europe, and many of the beautiful half-timbered houses adorned with rich carvings for which the town was famous.

The principal products of Hildesheim prior to World War II were agricultural implements, sugar, machinery, bricks, and stoves. Pop. (1946) 72,100.

**HILDRETH, RICHARD,** 1807-65, American historian and journalist, was born in Deerfield, Mass. He was a founder (1832) and for many years editor of the *Boston Atlas*; edited papers in British Guiana (1840-43), where he sojourned for his health; and was subsequently a member of the editorial staff of the *New York Tribune*. He became a U.S. consul at Trieste (1861), but was forced by ill health to resign, and died at Florence, Italy. His most important work is his *History of the United States* (6 vols., 1849-52), written from the Federalist point of view, and in many respects one of the best treatments of the period covered (1492-1821). He also published: *The Slave* (1836); *Banks, Banking, and Paper Currency* (1837); *Despotism in America* (1840); *Theory of Morals* (1844); *Theory of Politics* (1853); *Japan as It Was and Is* (1855).

**HILL, AMBROSE POWELL,** 1825-65, American soldier, was born in Culpeper County, Va. He was graduated from West Point and served in the Mexican War and in Florida against the Seminole Indians (1849-50). On the outbreak of the Civil War he entered the Confederate service as colonel; fought at the Battle of Bull Run; served in the Peninsula Campaign; and was promoted to major general (1862). At Antietam he commanded the Confederate right, where his timely arrival on the field checked the victorious Federals; and at Fredericksburg and Chancellorsville commanded a division under "Stone-

wall" Jackson. On the reorganization of the Army of Northern Virginia in May, 1863, Hill was placed in command of one of the three corps, and was promoted to lieutenant general. At GETTYSBURG he commanded the Confederate center, and it was the accidental meeting of one of his divisions with a force of Federal cavalry under Buford that precipitated the battle. He led his corps through the remainder of the war until he was killed at Petersburg, Va., while reconnoitering.

BIBLIOG.—D. S. Freeman, *Lee's Lieutenants* (1942-44).

**HILL, ARCHIBALD VIVIAN**, 1886—, British physiologist, was born in Bristol, England, and studied at Trinity College, Cambridge. He served as a fellow of Trinity College (1910-16) and of King's College (1916-25). He became Brackenbury professor of physiology at University College, London. For his remarkable work on the thermodynamics of muscle, Hill shared with OTTO MEYERHOF the 1922 Nobel prize in physiology and medicine. He was Foulerton research professor with the Royal Society after 1926 and secretary of that body after 1935. He also served as chairman of the executive committee of the National Physical Laboratory and during World War II was a member of the scientific advisory committee to the cabinet. He summarized his investigations in *Living Machinery* (1927).

**HILL, BENJAMIN HARVEY**, 1823-82, American legislator, was born in Jasper County, Ga., and was graduated from the University of Georgia (1844). He was admitted to the bar in 1845. He was elected to the state Senate in 1859, and from 1861 to the close of the Civil War was a member of the Confederate Senate. He was a prisoner of war in New York City for a short time in 1865. In 1875 he was elected to Congress as a Democrat, and in 1876 became a member of the U.S. Senate. In 1886 a marble statue of him was erected in Atlanta. He published *Notes on the Situation* (1867-68), denouncing the Reconstruction Acts.

BIBLIOG.—H. J. Pearce, Jr., *Benjamin H. Hill, Secession and Reconstruction* (1928).

**HILL, DANIEL HARVEY**, 1821-89, American soldier and scholar, was born in York District, S.C., and was graduated from West Point in 1842. He served through the Mexican War, and was brevetted major for gallantry at Contreras and Churubusco. Resigning his commission, he became professor of mathematics at Washington College, Lexington, Va. (1849-54), and at Davidson College, N.C. (1854-9); and was superintendent of the North Carolina Military Institute at Charlotte (1859-61). At the outbreak of the Civil War he entered the Confederate service, and was appointed colonel of the First North Carolina Regiment; was in command at Big Bethel (June 10, 1861); and was soon promoted to major general. He took a conspicuous part in the Peninsula Campaign; participated in the battles of Beaver Dam Creek and Gaines' Mill; won distinction at South Mountain and Antietam; was in command of the Richmond and Petersburg defenses during the Gettysburg campaign; became lieutenant general in July, 1863; and was in command of a corps at Chickamauga. He then served in North Carolina under J. E. Johnston, with whom he surrendered (April 26, 1865). After the war Hill founded and edited (1866-9) *The Land We Love*. He was president successively of Arkansas University (1877-85) and the Military and Agricultural College at Milledgeville, Ga. (1885-9). He published religious tracts, and wrote several chapters in Johnson and Buel's *Battles and Leaders of the Civil War*.

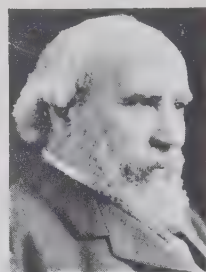
BIBLIOG.—D. S. Freeman, *Lee's Lieutenants* (1942-44).

**HILL, GEORGE WILLIAM**, 1838-1914, American astronomer, was born in New York City, and was graduated from Rutgers College (1859). In 1861 he became assistant in the office of the *American Ephemeris and Nautical Almanac*, and was subsequently its editor. His researches in celestial mechanics rank permanently among the memorable achievements in

that domain. His most important contribution in book form is *A New Theory of Jupiter and Saturn* (1890). His *Collected Works* (4 vols.) were published in 1905-7.

**HILL, ISAAC**, 1789-1851, American editor and statesman, was born in Cambridge, Mass., and served an apprenticeship as a printer. In 1809 he went to Concord, N.H., where he purchased the weekly, *American Patriot*, and changed its name to the *New Hampshire Patriot*. For more than two decades this paper was an important organ of the Republican (later the Democratic) party and during the Jackson administration reflected the opinions of the "KITCHEN CABINET" to which Hill belonged. He was a U.S. senator (1831-36) and governor of New Hampshire (1836-39). During the last 15 years of his life he issued an agricultural journal, the *Farmers' Monthly Visitor*. See JACKSON, ANDREW.

**HILL, JAMES JEROME**, 1838-1916, American railroad builder and entrepreneur, was born near Rockwood, Ontario, and studied at Rockwood Academy. He came to the United States in 1856, settling



James J. Hill

permanently at St. Paul, Minn. Beginning his career as a clerk in a steamboat office, he advanced steadily until in 1865 he was in charge of his own transportation agency. From 1867 to 1878 he was engaged in fuel transportation, and in 1872 he established, with Norman Kittson, the Red River Transportation Company, which opened communication between St. Paul and Fort Garry (now Winnipeg). In 1878, with Kittson, Donald Smith (later Lord

Strathcona) and George Stephen (Lord Mount Stephen), he formed a syndicate which secured control of the St. Paul and Pacific Railroad. The system was reorganized as the St. Paul, Minneapolis, and Manitoba Railway (1879), and Hill was successively its general manager (1879-81), vice-president (1881-82), and president (1882-90). In 1890 the system became known as the GREAT NORTHERN RAILWAY COMPANY, of which Hill was president (1890-1907) and chairman of the board of directors (1907-12).

Hill was an aggressive, efficient organizer, personally honorable but often ruthless in his business dealings. Under his administration the St. Paul, Minneapolis, and Manitoba was extended to Puget Sound, and placed in direct communication with the Orient through the organization of the Great Northern Steamship Company. Hill's railroads have been cited as the cause of a tremendous migration from Europe. That the influx was more a matter of business efficiency than philanthropy, however, is indicated in Hill's letter to his partner Lord Mount Stephen: "It is our best interest to give low rates and do all we can to help the country and create business."

After a dramatic struggle with EDWARD H. HARRIMAN, Hill acquired partial control of the Northern Pacific Railroad (1896) and of the Chicago, Burlington, and Quincy Railroad (1901). In 1901 he organized the Northern Securities Company as a holding company for all his corporations. The government proceeded against it in 1903, and in 1904 the Supreme Court ordered it dissolved, as being in violation of the Sherman Antitrust Act. See TRUSTS AND TRUST REGULATION.

Besides serving as director of several railroads, James J. Hill was director of the First National Banks of New York City, Chicago, and St. Paul. He erected the Hill Reference Library in St. Paul (1912), and gave liberally to many institutions, his benefactions including a gift of \$500,000 to establish a Roman Catholic theological seminary in St. Paul, and \$1,500,000 for the Roman Catholic cathedral in that city. He wrote *Highways to Progress* (1910) and *A*



*Brief History of the Great Northern Railway System* (1915). The James J. Hill Professorship of Transportation was set up at Harvard in 1915, endowed by 74 of his friends and admirers. C. A.

**HILL, OCTAVIA**, c. 1838–1912, English social reformer, was born in London. Convinced that the poor are greatly influenced in their habits and ways of thought by their domestic and sanitary surroundings, she purchased three cottages in Marylebone (1864), the money for which was advanced by John Ruskin, and successfully carried out her scheme. Many other blocks of dwellings in London eventually came under her management. She actively supported the Artisans' Dwellings Act of 1874, and helped develop the Charity Organization Society. She wrote: *Homes of the London Poor* (1875); *Our Common Land* (1878).

**HILL, Sir ROWLAND**, 1795–1879, English post office reformer, was born in Kidderminster. In 1837 he advocated a low and uniform rate of postage, to be prepaid by stamps, between all places in the British Isles irrespective of distance (see **POST OFFICE**); and in 1839 he was made secretary to the postmaster general. He also established the book post (1848); reformed the money order office (1848) and the packet service; and interested himself in the colonization of South Australia.

**HILLA**, or **Hillah**, town, central Iraq, the principal center of Hilla Liwa (province), on the Euphrates River, 60 miles S of Baghdad. It lies near the site of ancient Babylon, from whose ruins the city was largely built. Hilla has trade in grain and manufactures of silk and woolen textiles. Pop. (1935) 15,000.

**HILLDRING, JOHN H.**, 1895–, American army officer, was born in New Rochelle, N.Y., and educated at Columbia University and the University of Connecticut. Commissioned a second lieutenant in 1917, he rose to be a major general in 1942. After serving with the A.E.F. in France during World War I, he had various assignments, commanding Civilian Conservation Corps districts in Texas and Arizona (1936–39), and with the personnel division of the War Department General Staff (1939–42). From being commanding general of the 84th Infantry Division at Camp Howze, Tex. (1942), he was transferred to the Office of the Chief of Staff and was the first director of the Civil Affairs Division, where he developed policies for the Allied Military Government in Europe. He was assistant secretary of state (1946–47), and in 1949 became director of the Pressed Steel Car Company.

**HILLEL**, called **Hababli** and **Hazaken**, c. 50 B.C.—?A.D. 10, one of the greatest and most influential doctors of the Jewish law, was born in Babylonia, of poor parents, but in the female line of royal (Davidian) descent. When 40 years old—so runs the Talmudic account—he migrated into Palestine for the purpose of studying the law under Shemaia and Abtalion, the great masters of the period. Five or six years after Herod had mounted the throne, Hillel was elected president of the Sanhedrin. He was the first who collected the numberless traditions of the oral law, and arranged them under six heads. See **MISHNA**.

**HILLEROD**, county, Denmark, in NE Sjælland (Jylland), bounded on the N by the Kattegat, on the E by the Øresund, S by Copenhagen (København) County, and W by Ise Fjord. The chief city of the county is Hillerod.

**HILLMAN, SIDNEY**, 1887–1946, American labor leader, was born in Lithuania and came to America in 1907. Representing over 50,000 workers in the Hart, Schaffner and Marx strike (1910), he won a permanent arbitration board and improved working conditions for the employees. He led the revolt against United Garment Workers, resulting in the formation of the Amalgamated Clothing Workers of America. Hillman was president (1914–46); the membership reached 325,000 in 1944, or 95 per cent of the workers in the industry. Wages and hours

put his union on a par with those of the first rank; unemployment insecurity and the sweatshop disappeared. See **GARMENT INDUSTRY**.

Hillman believed that if employees asked more than employers could afford to give, the workers would destroy their jobs. Consequently the Amalgamated, through its bank, was unique in granting loans to employers who would maintain union standards to compete with those who would not. He was assailed by radical groups for pursuing a strict trade union policy that kept aloof from radical doctrine. Amalgamated became affiliated with the C.I.O. (1935), which Hillman helped organize. He was a member of the Labor Advisory Board of the NRA (1933), the National Industrial Recovery Board (1935), and the National Defense Commission to stimulate war production (1940); chairman of the Political Action Committee of the C.I.O. (1943–46); and a leader of the U.S. delegation to the World Trade Union Congress in London (1945). N. S.

**HILLQUIT, MORRIS**, 1869–1933, American socialist, was born in Riga, Latvia, and emigrated to the United States in 1886. He was graduated from the New York University Law School (1893). He was chairman of the national committee of the Socialist party (1913–33) and wrote numerous works on the history, theory, and practice of Socialism—among them *Socialism Summed Up* (1912); *Socialism—Promise or Menace?* (with J. A. Ryan 1914); *From Marx to Lenin* (1921); *Loose Leaves from a Busy Life* (1934).

**HILLSBORO**, town, S New Hampshire, in Hillsboro County, on the Contoocook River, the Boston and Maine Railroad, and U.S. Highway 202; about 20 miles SW of Concord. Franklin Pierce was born nearby. Pop. (1950) 2,179.

**HILLSBORO**, village, SW Ohio, county seat of Highland County, on the Baltimore and Ohio and the Norfolk and Western railroads, and U.S. highways 50 and 62; about 60 miles E of Cincinnati. It is a trading center for a large area. Pop. (1950) 5,126.

**HILLSBORO**, city, NW Oregon, county seat of Washington County, on the Oregon Electric and the Southern Pacific railroads, about 17 miles W of Portland. Pop. (1950) 5,142.

**HILLSBORO**, city, E central Texas, county seat of Hill County, on the Missouri-Kansas-Texas and the Texas Electric railroads, and U.S. highways 77 and 81; about 35 miles N of Waco, in a cotton growing area. Pop. (1950) 8,363.

**HILLSDALE**, city, Michigan, county seat of Hillsdale County, on the St. Joseph River, and the New York Central Railroad, 88 miles SW of Detroit. It was settled in 1834 and is the seat of Hillsdale College. Pop. (1950) 7,297.

**HILLSDALE COLLEGE**. See **COLLEGES**.

**HILLSIDE**, township, New Jersey, Union County, on the Lehigh Valley Railroad, between Newark and Elizabeth. Although many residents commute to Newark and New York, the township has industries which produce Diesel engines, castings, hand trucks, silica products, cork, insulated wire, and drug and toilet products. Pop. (1950) 21,007.

**HILLYER, ROBERT SILLIMAN**, 1895–, American poet, was born in Orange, N.J. He graduated from Harvard University in 1917, served with the French and American armies in World War I, and in 1919 began teaching at Harvard, where he became Boylston professor of rhetoric and oratory. His austere, traditionalist verse includes: *Sonnets and Other Lyrics* (1917); *The Hills Give Promise* (1923); *The Gates of the Compass* (1930); *A Letter to Robert Frost and Others* (1937); *In Time of Mistrust* (1939); *My Heart for Hostage* (1942); and *The Death of Captain Nemo* (1949), a long narrative poem. He was awarded the 1934 Pulitzer prize for his *Collected Verse* (1933). Among his other works are the novel *Riverhead* (1932) and two books on prosody, *Some Roots of English Poetry* (1933) and *First Principles of Verse* (1938).



EWING GALLOWAY

### The Himalayan sky line near Nepal-Tibet border

**HILO**, city, Hawaii, principal city and seaport of the island of Hawaii, on Hilo Bay, on the E coast of the island. The harbor has a breakwater and a beach park on Coconut Island. The city lies amidst luxuriant tropical vegetation and ships sugar, molasses, rice, and the famed Kona coffee. Hilo entertains many visitors to the well-known volcanoes in Hawaii National Park. A tidal wave in 1946 leveled the waterfront area, destroying a part of the breakwater, and caused loss of life and damage in other parts of the town. Pop. (1950) 27,198.

**HILONGOS**, seaport, Philippine Islands, Leyte, on the SW coast at the mouth of the Salog River, 70 miles SSW of Tacloban, island capital. There is a good harbor. Pop. 27,310.

**HILVERSUM**, town, Netherlands, North Holland Province, 18 miles by rail SE of Amsterdam, of which it is a residential suburb. It has textile industries. Pop. (1950 est.) 88,219.

**HIMACHAL PRADESH**, centrally administered territory, NW India, consisting of two sections: the northern, bounded by Jammu and Kashmir on the N, E, and W and the Punjab on the S; and the southern, bounded by Punjab on the N, Tibet on the E, Uttar Pradesh on the S, and Punjab on the W; area 10,600 sq. mi.; pop. (1951) 983,367. The region consists of the foothills of the Simalik Range. The most important products are potatoes, fruits, salt, and forest products. The leading cities are Chamba, Mandi, and Nahan. The state of Himachal Pradesh was created in 1948 by merger of several princely states of the Punjab. In 1956 it became a centrally administered territory in the Indian republic.

**HIMALAYAS**, more properly the Himalaya, from Sanskrit *him*, "snow" or "cold"; *alaya*, "abode"; the name given by the Aryan immigrants into the plains of upper India to the snowclad ranges to the north. They are the southern and western face of the great tableland of Tibet and include the mountain system lying between the southward bend of the Indus (in 75°E and 36°N) on the west, and the southward bend of the Brahmaputra (in 39°E and 30°N), on the east. The area thus included starts from the Pamir Plateau "roof of the world" and extends to the southeast about 1,500 miles in length, with a breadth of 150 to 200 miles, which increases toward the northwest. Large portions of these mountains are little known. Their influence over the climate of India is marked since they protect it from the gradual desiccation characteristic of central Asia by precipitating the moisture of the monsoons which maintain the enormous glaciers which feed hundreds of streams useful for irrigation. See PAMIRS, THE.

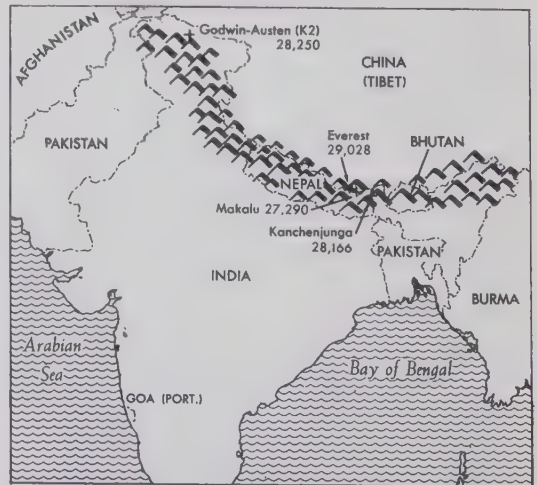
**Ranges and Peaks.** Throughout the greater part of their length the Himalaya form a system of parallel and converging ranges running in a general westerly and northwesterly direction. The southern foot of the system rests upon the plain of the Ganges, and the edge of the outermost hills is skirted as far west as the Ganges by the Tarai, a belt of swampy grassland

10 to 15 miles in width. Above the Tarai lies a belt of forest, called the Bhabar, beyond which are the sub-Himalaya, known for a considerable portion of their length as the Siwalik, rising to heights of from 3000 to 4000 feet above the sea, and skirting the main ranges from the Brahmaputra to the Indus.

The Lesser Himalaya, from 12,000 to 15,000 feet in elevation, and about 60 miles in breadth, rise either immediately behind the first line, or are separated from it by a valley often of considerable extent. From the Indus to the watershed of its tributaries north of the Sutlej, the system reaches its greatest height and bears the name of the Pir-Panjal, or Dhaolidhar Range. Along the Lesser Himalaya are most of the hill stations frequented by Europeans: Marri, Dalhousie, Simla, and Masuri.

Above the Lesser range tower the Great Himalaya, a mass with considerable irregularity of direction. The mean height is about 20,000 feet. The highest peaks are not upon the main axis but sometimes are terminals to some of the numerous spurs. Nanga Parbat rises abruptly from the Indus Valley, which is itself 3,000 feet above sea level, to more than 26,000 feet (see NANGA PARBAT). Several peaks more than 22,000 feet high surround it.

Above the deep gorge that the Sutlej has worn, the range widens into a second cluster of stupendous summits, flanked by extensive glaciers, the gathering ground of the Gangetic system. Badrinath, Kedarnath, Gangotri, Jamnotri, and Nanda Devi, all 22,000 to 25,000 feet high, are among the peaks. It is between the Sutlej and the confines of Bhutan that the southern range of the Himalaya attains the greatest and most sustained elevation. In Nepal several peaks exceeding 25,000 feet are located west of Mount Everest (see EVEREST, MOUNT), the highest point (29,028 ft.) in the world. To the east of Everest on the frontier of Sikkim rises Kanchenjunga, or "the Lord of the Great Snow" (28,166 ft.), second in height to Everest in the Himalaya proper. The southern chain dips throughout on its northern side in a series of synclinal steps to a level of some 15,000 feet, from which the northern range rises. Between this level and the Tibetan Plateau the valley, or gorge, of the Tsangpo (known as the Brahmaputra farther along in its course) intervenes from 82°E to 94°E. The Tsangpo, starting at an altitude of 15,000 feet, falls to little more than 500 feet by the time it enters upper Assam. West and northwest of the headwaters of the Tsangpo the Himalayan system tends to merge directly into the Tibetan Plateau. The Muztagh ranges originate in the Pamirs, from which they are separated by the Hunza and Gilgit valleys. Greatest elevations are found north of the Indus, where several peaks of the Karakoram



Location Map of the Himalayas





Simla, the Himalayan summer capital of India

range surround Mount Godwin-Austen, (K-2, 28,250 ft.), second highest mountain peak in the world. (See GODWIN-AUSTEN.) From the Karakoram Range the system tends east and, after entering the Tibetan Plateau, bends southeast to Kailas (22,028 ft.).

**Geology, Rivers, Vegetation.** The Himalaya are of the Alpine type, among the newest of mountains, and were formed by pressure from the north and by movements which lasted into and even later than the Pliocene period. The occurrence of metamorphic rocks above nonmetamorphic observed near Simla and elsewhere in the northwestern Himalaya is attributed to overthrusting and it is believed that this overthrusting is extensive throughout The Himalaya. The difficulty of recognizing the overthrusting in some parts is due to the fact that the thrust and the overthrust rocks are similar. The northern zone of The Himalaya is in general a continuous series of highly fossiliferous marine sedimentary rocks; the central geologic zone is mostly crystalline and metamorphic rocks with unfossiliferous sedimentary deposits (Purana age); in the sub-Himalayan zone (Siwalik ranges) are sedimentary river deposits.

The separation of the river systems between India and Central Asia is effected by the Karakoram Range and its extensions. In the case of the Gangetic system, although the JUMNA and the GANGES both rise to the south of the central range of The Himalaya, the tributaries east of the two rivers originate considerably to the north, as does the Subansiri, the most important of the Indian tributaries of the BRAHMAPUTRA. The snowy region of The Himalaya is plentifully studded with glaciers, some of them of great extent. The longest in The Himalaya, and probably the largest other than those of the Alaskan and Polar regions, is the Siachen in the Karakoram, over 44 miles long.

The passes through this veritable mountain wall are few and difficult and they are the most elevated in the world, seldom falling below 18,000 or 19,000 feet. The Chumbi Valley carries the principal road from India into Tibet, giving access to Lhasa, the capital. Other passes are Ibi-Gamin (20,457 ft.), Parang (18,500 ft.), Saltoro (18,200 ft.), Bolan (used by Alexander). In some regions explorers have found no passes for several hundred miles.

The vegetation of The Himalaya shows the usual transition from the snow line through alpine vegetation, coniferous forests, deciduous forests, warm temperate and tropical jungles. Between the middle and outer Himalaya is the famed Vale of Kashmir, carpeted with mountain flowers and bearing on its slopes apple, pear, and orange trees. The region of The Himalaya is one of the richest in the world in fauna, particularly in birds. See KASHMIR AND JAMMU.

Many of the Himalaya peaks remain unconquered by mountain climbers, although there have been many attempts on many peaks, including Everest,

## Hindemith

the highest of them all. During the summer of 1947 Swiss climbers succeeded in reaching the summits of White Dome (20,496 ft.), Kedarnath (20,820 ft.), Satopanth (21,225 ft.), Kalindi Parbat (18,306 ft.), Balbala (19,254 ft.), and Nanda Gunthi (18,927 ft.), all in India near the Tibetan border.

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**HIMEJI**, city, Japan, Honshu, Hyogo Prefecture, 30 miles by rail NW of Kobe, a road and railway junction. It is the site of the famous 14th century feudal stronghold "Heron Castle," enlarged by Toyotomi Hideyoshi in 1577. Himeji has long been known for its production of cotton goods and stamped leather. In the years before World War II it produced considerable quantities of pig iron and steel. During the war the city was almost half destroyed by American bombs. Pop. (1950) 252,315.

**HIMERA**, ancient city, Italy, on the N coast of Sicily, 14 miles SW of Cefalu. It was in 480 B.C. the scene of the defeat of the Carthaginian Hamilcar by the Sicilian Greeks under Gelon. In 409 B.C. the city was destroyed by Hannibal.

**HIMMLER, HEINRICH**, 1900–1945, German Nazi head of the S.S. and Gestapo forces, was born in Munich, the son of a Catholic school supervisor. He joined Hitler's National Socialist German Workers' Party (1919) and secured the leadership of the S.S. troops (1929). Becoming police commissioner of all German states (1936), he strengthened the S.S. (Schutzstaffeln, "Elite Guards") into a powerful organization of 600,000 men, ardently devoted to pagan ideals of Nordic superiority. S.S. men, a law unto themselves, were picked murder gangs who arrested and executed all opposition ferreted out by the GESTAPO, Himmler's secret police, which operated with brutal precision. Responsible for murdering thousands of Jews and keeping 10 to 12 million slave laborers working in Germany, he made extensive preparations for a Nazi guerilla army, estimated at 500,000, to go underground after Germany's defeat. As minister of the interior and home defense he dominated even Hitler by 1944, driving the terrorized Germans to maintain the war to the last ditch. Hitler's will expelled him with Goering from the party as traitors to the state. He committed suicide when captured by the Allies in May, 1945.

**HIMYARITIC LANGUAGE.** See SABAEANS; SEMITE.

**HIMYARS**, or **SABAEANS**, former people of Yemen, Arabia, the Homerites of Ptolemy. See SABAEANS.

**HINCMAR**, c. 806–82, Frankish churchman. He was appointed archbishop of Rheims (845) and was opposed to political or papal interference in the Frankish church. He was also opposed to the predestinarian theories of Gottschalk, on the subject of which he wrote two treatises. His continuation of the *Annales Bertiniani* (1645), covering the period 861–82, was published in Paris.

**HIND, JOHN RUSSELL**, 1823–95, British astronomer. He was sent in 1844 as one of the commission appointed to determine the exact longitude of Valentia, and on his return became the observer in Bishop's Observatory, London. Here he noted a number of new movable stars, and between 1847 and 1854 discovered 10 minor planets.

**HINDEMITH, PAUL**, 1895–, German composer, was born in Hanau. His youth was not an easy one. He began the study of music at the age of 11, and after several years began to earn his own living by playing the violin for dances, for motion pictures, and in musical comedy theaters. He first studied composition with Bernard Sekles and Arnold Mendelssohn in Frankfurt. After a period of service in the army, he became concertmaster of the Frankfurt Opera, which position he held until 1923.

Turning then to the viola with which he was afterward identified, he helped found the Amar Quartet, with which he toured extensively. In 1927 he was made professor of composition at the Berlin Hochschule where he remained until the advent of the Third Reich, which soon displayed hostility to his work. The first performance of his *Matthias the Painter* by the Berlin Philharmonic in 1934 brought upon its conductor Wilhelm Furtwängler the disapproval of the Reich Chamber of Music. Hindemith resigned his position at the Hochschule soon after.

In 1935 he accepted a commission from the Turkish government to help organize its musical education along occidental lines. This task occupied him for several years. Afterward he toured widely as viola soloist and conductor of his own works. He visited the United States in 1938, where he later made his home, settling finally at Yale University as a member of the music faculty.

**Compositions.** Hindemith first became known as a composer of chamber music. His early works, not only for string quartet but for combinations of wind instruments, were performed in festivals at Donaueschingen, Salzburg, and Venice from 1921 to 1925. In his earliest writing the influences of Brahms and Reger were apparent, but gradually a greater objectivity, with emphasis on counterpoint of a very dissonant nature emerged, so that even his friends began to speak of his music as atonal. It is true that in the numerous works labeled *Kammermusik*, the operas *Cardillac*, *Hin und Zurück* and *Neues vom Tage*, and the *Philharmonic Concerto* for orchestra, all composed during his second period, the feeling of tonality is decidedly vague, but Hindemith has himself disavowed atonality and its principles.

Starting with *Matthias the Painter*, his linear counterpoint grew less harsh, the tonality more clearly defined, and a real beauty replaced the former austerity. Among the works exemplifying this greater mellowness are *Der Schwanendreher*, a concerto for viola based on German folk tunes, the ballet *Nobilissima Visione* on the life of St. Francis, his *Symphony in E flat*, and his *Symphonic Metamorphosis on Themes by Carl Maria von Weber*.

The nature of Hindemith's practical experiences with music in his youth undoubtedly had much to do with his conviction, expressed as early as 1927, that composers should compose more for practical reasons and specific social purposes, such as community festivities, children's games, and amateur performances. Much of his output was aimed at such uses; *Wir bauen eine Stadt*, *Pioneer Musiktag*, and a diversity of other choral and instrumental, educational, occasional, incidental, radio and film music fall into this category of *Gebrauchsmusik*.

**Theories on Composition.** Hindemith's stature was notably increased by his lucid writings on music in his *Craft of Musical Composition*, a theoretical work of great importance. To those to whom his music had not already done so, it revealed a mind in which scientific accuracy and aesthetic sensitiveness are finely balanced. His rejection of the established habits of chord building in thirds and other practices which he deems arbitrary is compensated for by a clear statement of new methods. A thorough re-examination of the various elements of music—tone quality, pitch, intervals, chords, keys—results in a ranking of all possible harmonies, however constructed, in ratio of stability or tension to each other. Their juxtaposition and succession are charted, revealing the key center toward which they tend. Thus a method of analysis is provided which not only throws light on Hindemith's own compositions but which is applicable to and illuminating in regard to all music, past or present. See *MUSIC, Polytonality*.

IRWIN FISCHER

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**HINDENBURG, PAUL VON BENECKENDORFF UND VON**, 1847–1934, German soldier and public official, was born in Posen. At 19, as a



PAUL'S PHOTOS

Von Hindenburg

subaltern in the Austro-Prussian War (1866), he was decorated for a brilliant feat at Sadowa. As a captain in the Franco-Prussian War (1870), he took part in the storming of St. Privat, which cost the Germans 40 per cent of their force, and was again decorated. He was then given a military education (1872–75), after which he was placed on the General Staff and made head of a War Department bureau. He was promoted to major general in 1900, lieutenant general in 1905, and

was retired in 1911. Following the outbreak of the World War and the Russian invasion of East Prussia, he was recalled to active duty and given command of the Eighth Army. By bold and hazardous strategy he and his chief of staff, LUDENDORFF, won the great victory of TANNENBERG (Aug. 26–31, 1914) over the Russian invaders of East Prussia. There has been some dispute as to who originated the successful scheme of battle. Hindenburg defeated the Russians in several subsequent engagements, became a national hero, was made field marshal, and was given command of the Austro-German forces on the Eastern front. In August, 1916, he succeeded von Falkenhayn as chief of the General Staff. After the Armistice he retained chief command until June, 1919, rendering valuable service in demobilizing the armies. In 1925, after the death of Ebert, first president of the German Republic, von Hindenburg was elected to succeed him. In April, 1932, he was elected for a second term of seven years. He was unable to stem the rising tide of Nazism, and eventually acquiesced in HITLER's dictatorship. He died on Aug. 2, 1934, at the age of 87. In 1935 his body was moved to the Tannenberg Memorial in a large national ceremony. In 1920 he published *Aus Meinem Leben*. See GERMANY, *History*; WORLD WAR I.

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**HINDENBURG.** See ZABRZE.

**HINDMAN, THOMAS CARMICHAEL**, 1828–68, American soldier and statesman, born in Knoxville, Tenn. He volunteered in the Mexican War and rose to the rank of lieutenant. In 1858 he became a member of Congress but as a leader of the secessionist movement he resigned when Arkansas seceded. A major general in the Civil War, his vigorous enforcement of conscription and martial law brought popular disapproval and a transfer to the east. He opposed the congressional reconstruction program and was assassinated in his home in Arkansas.

**HINDU KUSH**, a westward prolongation of The Himalaya, from which it is separated by a gorge of the Indus River. The Hindu Kush is a series of ranges running parallel with each other, stretching southwest from the Pamirs for more than 350 miles, and having a breadth of 200 miles. The ranges spread over the northeast angle of Afghanistan and throw out many spurs toward the south. These mountains are crossed by several passes, of which the Wakhjir, at the northeast extremity, marks the junction of Pakistan, Afghan, and Chinese spheres; the Bamian, or Irak, forms the trade route between Pakistan (Chi-



tral) and central Asia; and the Khawak (13,000 ft. high) connects Badakhshan and Kafiristan. Tirich Mir (25,263 ft.), on the frontier of Chitral, is the highest peak.

**HINDUISM**, a religious and social system accepted and practiced by a majority of the people of India. Broadly used, the term includes, not only the religious and social systems as they now exist in India, but also the historical forms in which the religion and its social manifestations appeared.

Hinduism does not rest so much upon a foundation of belief as it does upon birth and conduct. Unlike most of the major religions of the world, it has no founder and does not make use of fixed creeds, although there is a large body of sacred Hindu literature. In its various historic and contemporary forms, Hinduism is exceedingly complex and variable, though there are some fundamental principles common to all forms of the religion, which justify the application of the name Hinduism to all branches of the faith.

Hinduism has almost universally considered the early Vedic literature to be of fundamental importance, although some of the more recent movements within Hinduism have rejected the writings. The principles of reincarnation and karma have been widely accepted among Hindus, and a high regard for the holy man is practically universal. Hinduism has always been characteristically mystical and, in the main, tolerant toward other religions, even to the point of assimilating elements from religions which have been brought in contact with it.

The historical development of Hinduism tends to fall into five divisions, although there is a certain amount of overlapping of the periods. These five divisions are: (1) Vedic Hinduism; (2) Transitional Brahmanic Hinduism; (3) Speculative Hinduism; (4) Divergent Hinduism; (5) Reformed Hinduism.

**Vedic Hinduism** had its origin in the pre-Aryan native religion of India, which was largely sacrificial in character. It is the *VEDAS*, or *Scruti*, which constitute the foundation scriptures of the faith. These sacred writings are known as: *Rig*, *Yajush*, *Saman*, and *Atharvan*; each one contains Mantras (hymns), *Upanishads* (discussions), *Samhitas* (texts), and *Aramyaka* (methods and value of worship). The great Hindu epics, the *MĀHABHĀRATA* and the *RĀMĀYANA*, evolved as a result of the Aryan conquests and have greatly influenced Indian thought and life. Vedic Hinduism recognized nature gods, such as Varuna (sky); Agni (fire), Ushas (dawn), and *INDRA* (storm).

**Brahmanic Hinduism** was brought about by the deterioration of Vedic Hinduism into an elaborate and highly formalized system of ceremonialism. The **CASTE** system developed during this period, the Brahmins being the highest caste and the Sudra the lowest. Strict limitations were placed upon each caste, and penalties were always inflicted for infractions of the rules of conduct. To the authority of the Vedic literature was added the authority of the Brahmins. The Brahmanas, written about the seventh century B.C., were prose versions of the Vedas, giving the elaborate ritual of worship to be observed by the Brahmins. The characteristic Hindu doctrines of karma and transmigration of souls were a development of **BRAHMANISM** during this period of Hinduism. **BRAHMA**, the creator God, was worshiped as the supreme deity.

**Speculative Hinduism** developed in India at about the same time that philosophical inquiries concerning the nature of the world and of man were taking place in Greece. Instead of being concerned solely with formalized worship, Hindus now began to speculate on the nature of the soul, its origin, and its relation to the Divine. Six schools of philosophical inquiry arose, each recognizing the Vedas as supreme in authority but interpreting them differently. These schools are: the Nyaya, Vaisheshika, YOGA, Mimamsa, Sankhya, and **VEDANTA**. Brahma was made less of a

personal deity and more a divine abstraction.

**Divergent Hinduism** was the natural result of the reaction between the decadent Hinduism of Brahmanism and the philosophical speculation which had emphasized knowledge rather than ritual. **JAINISM** and **BUDDHISM** may be considered partly the outgrowth of speculative Hinduism on the one hand and Brahmanism on the other. Although both movements are regarded as separate religions, they have sometimes been considered heretical sects of Hinduism. **SIVA** and **VISHNU** increased in popularity as the third god of the Hindu trimurti (Brahma) declined. Hindu sects devoted to the worship of these two deities arose, and, in addition, many thousands of lesser deities began to be worshiped as Hinduism became increasingly complex.

**Reformed Hinduism** began with the impact of the invasion of the Moslems (about A.D. 1000), which brought Islam and Hinduism into close contact with one another. A syncretistic movement



PAN AMERICAN AIRWAYS

#### Hindu bathing ghat in ancient city of Muttra

resulted, which led to the development of the Sikh religion (see **SIKHS**) in the 16th century A.D. Further reform movements occurred as Western culture and particularly Christianity entered India, resulting in the formation of the **BRAHMA SAMAJ**, the Arya-Samaj, the Rama-Krishna, and similar Hindu religious societies.

The **CASTE** system of Hinduism did much to stifle economic and social progress in India. In 1948 as a climax of the efforts of Ghandi and others to improve the condition of the "untouchables," the Constituent Assembly in New Delhi abolished the practice of untouchability in any form. Friction between Hindus and Moslems (whom Hindus outnumber about three to one) was a leading reason for the delay in granting independence to India. Feeling between the two religious groups resulted in many disturbances, particularly during religious celebrations or political crises. See **INDIA**. W. G. D.

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**HINDUSTAN**, derived from the Persian **Hindo-stan** (both forms are used in India), meaning the "land of the Hindus." The early Persians applied the term to the Indus River Valley. Hindustan has been used, too, to designate the area between the Himalayas on the north and the Vindhya Mountains on the south, and between the Indus River on the west and

Bengal on the east. Hindustan has also been used to describe all of India.

**HINES, FRANK THOMAS**, 1879–, American Army officer and administrator, was born in Salt Lake City, Utah, and enlisted as sergeant in the Utah Light Artillery (1898). He fought in 24 engagements in the Philippine Islands, was commissioned (1899) and entered the regular army (1900). During World War I as chief of the Embarkation Service (1918) and chief of the Transportation Service (1919) he was largely responsible for the transfer of 2,082,000 troops overseas and their return. Resigning as brigadier general (1920), he became director of the Veterans Bureau (1923) and administrator of Veterans Affairs (1930–44). General Hines was ambassador to Panama (1945–48). DON RUSSELL

**HINES, JOHN LEONARD**, 1868–, American army officer, was born in White Sulphur Springs, W. Va., and graduated from West Point in 1891. After extensive service in the Spanish-American War, Pershing's expedition into Mexico (1916–17), and World War I, Hines was commissioned major general in 1921, and in 1924 succeeded General Pershing as chief of staff. He became commander of the Philippine department in 1930 and retired from active service in 1932.

**HINES, WALKER DOWNER**, 1870–1934, American lawyer and administrator, was born in Russellville, Ky., and graduated from the University of Virginia. An outstanding man in railroad law, Hines became assistant to Director General McAdoo in the wartime administration of railroads in 1918, succeeding McAdoo the next year. Hines arbitrated a shipping dispute on the Danube (1920–21), investigated Danube navigation conditions for the League of Nations (1925), and led an advisory group of economists to the Turkish government (1933). He wrote *War History of American Railroads* (1929). In 1906 he had established a law practice in New York City to which he returned when other duties permitted. He died in Italy en route to Ankara.

**HINGHAM**, town, Massachusetts, Plymouth County, on the S shore of Massachusetts Bay and the New York, New Haven, and Hartford Railroad; about 12 miles SE of Boston, of which it is a residential suburb. Originally inhabited by Algonquin Indians, the town was named by the English, who came about 1634 and chose for their settlement the name of their former home in England. In 1665 three Indians conveyed the land to the settlers. During the early 19th century mackerel fishing engaged most of the residents. Pop. (1950) 10,665.

**HINGSON, ROBERT ANDREW**, 1913–, American physician, was born in Anniston, Ala., and studied at the University of Alabama and Emory University. After 1941 he was connected with the U.S. Marine Hospital on Staten Island, N.Y., where he became chief of anesthesia. During 1941–42 he and the hospital's chief obstetrician, Waldo B. Edwards, devised a method of alleviating the pain of childbirth by continuous caudal analgesia. Hingson lectured on this technique at the Philadelphia Lying-in Hospital and the Jefferson Medical College and wrote, with Clifford B. Lull, *Control of Pain in Childbirth* (1944). In 1943 he was commissioned a commanding surgeon with the U.S. Public Health Service, and later was associated with Johns Hopkins University. In 1947 the U.S. Junior Chamber of Commerce chose him as one of the country's outstanding young men.

**HINNOM, THE VALLEY OF**. See GEHENNA.

**HINNY**, the hybrid offspring of a stallion and a female ass. It is less common, because less valuable, than the cross between a mare and male ass. (See MULE.) It is smaller than the mule, and inferior in strength, but in mental characteristics takes after the male parent, and is therefore more docile.

**HINSDALE**, village, Illinois, Du Page County, on the Burlington Railroad, about 17 miles SW of Chicago. Many of its residents work in Chicago.

Hinsdale was settled in 1864 and incorporated in 1873, annexing the older village of Fullersburg in 1923. Pop. (1950) 8,676.

**HINTON**, city, S West Virginia, county seat of Summers County, on the New River, and the Chesapeake and Ohio Railroad, 64 miles SE of Charleston. The industries of the city center in the railroad shops and yards. Hinton also is a shipping point for agricultural produce and livestock. Laid out by John Hinton in 1831, the settlement grew rapidly after the arrival of the railroad in 1871. Pop. (1950) 5,780.

**HIP**. See PELVIS.

**HIPPARCHUS**. See HARMODIUS.

**HIPPARCHUS**, 160–125 B.C., Greek astronomer and mathematician, was born in Nicaea, Bithynia, and spent most of his life in Rhodes. He is regarded as the founder of systematic astronomy and of trigonometry which is based on the table of sines that he formulated. He calculated the precession of the equinoxes at 36 seconds a year, determined the length of the solar year as 365 days, five hours, and 49 seconds and of the lunar month as 29 days, 12 hours, 44 minutes, and 2½ seconds, and estimated that the moon was 250,000 miles distant from the earth. He also originated the method of indicating positions on the earth by latitude and longitude, invented the planisphere, and listed 1,080 fixed stars in one of the earliest star catalogues. Several authorities credit him with the discovery of the evection (orbital inequality) of the moon. Although he wrote extensively, his only surviving work is a commentary on the *Phainomena* of EUDOXUS; PRECESSION.

**HIPPARION**, one of the fossil ancestors of the HORSE, the remains of which are found in the Pliocene strata of Africa, India, and China, and in the Upper Miocene of North America. It was about four feet high at the shoulders, and had lateral toes on each side of the feet, which were complete though small. The ulna and fibula, however, were imperfect, and the lateral splint bones apparently did not reach the ground. It is a somewhat more advanced type than *Anchitherium* or *Protohippus*, especially in the dentition.

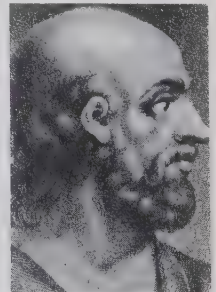
**HIPPEASTRUM**. See AMARYLLIS.

**HIPPER, FRANZ VON**, 1863–1932, German vice admiral who, with Admiral Von Scheer, commanded the German naval force at the Battle of JUTLAND (1916). In the first hour of fighting he destroyed the *Queen Mary* and the *Indefatigable* and is credited with saving Germany's main fleet through his methods of gunnery and maneuver. Von Hipper subsequently made raids on the British coast.

**HIPPO REGIUS**. See BÔNE.

**HIPPOCRATES**, c. 460–c. 377 B.C., the "Father of Medicine," lived in the Golden Age of Greece. That a physician named Hippocrates did live at this time is known from the writings of Plato. All else about this man is legend. It is probable that the legendary Hippocrates represents the thinking and accomplishments of a number of physicians of that time, though it is customary to refer to them as if they were attributes of one individual who has become the symbol of the ideal physician. In Hippocrates' time medicine emerged from its superstition-ridden past into a new era; disease came to be recognized as a natural rather than a supernatural phenomenon, and healing became the function of the physician rather than that of the priest. See MEDICINE.

According to legend, Hippocrates was born on the island of Cos. He had two sisters, *HYGIEIA* and *Pana-*



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**Hippocrates**



cea. His father, a physician named Heraclides, was his first teacher. As most physicians of antiquity were itinerant practitioners, it is probably true that Hippocrates traveled widely, moving from place to place, healing the sick, and acquiring a reputation that spread as far as Persia. The legends do not agree as to the length of Hippocrates' life; according to some he lived to be 104. Over his grave, as the story goes, there was a beehive, and the honey from it was said to cure children of thrush.

**The Hippocratic Collection** of more than a hundred books and monographs are all that is known of the practices and teaching of Hippocrates. Whether Hippocrates himself wrote them is not known, but that he inspired them is generally agreed. They have been translated into many languages and some were used as textbooks as recently as the turn of the 19th century. Many of the Hippocratic teachings about the structure and physiology of the body have been discarded. Health was thought to depend on a state of balance in the humours of the body, and a disturbance of this balance to cause sickness. The theory of the humours, four in number according to late Hippocratic writings (blood, black bile, yellow bile, and mucus), was later systematized by GALEN, and dominated the practice of medicine for centuries. The Hippocratic system of treatment was based on an imitation of the processes of nature. Air and food were recognized as being necessary for life, and diet was an essential part of treatment. Drugs, mainly vegetable, were used mostly for their purgative effect. Caution and the knife were resorted to for the purpose of relieving the body of noxious humours, and the importance of cleanliness in surgery was emphasized.

Some of the methods of Hippocrates were as modern as though he were writing today. He emphasized the value of careful observation and accurate records. Especially modern was his insistence that the physician focus his attention, not merely on the disease, but on the patient—studying him in his environment during health and disease—noting the effects, on illness and recovery, of diet, climate, exercise, and mental health. Galen in the second century perhaps did more than any other person to keep the legend and the teachings of Hippocrates alive. On the basis of the Hippocratic writings, he built up a system of medical theory that lasted into the Middle Ages.

**Hippocratic Oath.** Included in the Hippocratic writings is the Hippocratic oath, which is still the ethical guide of the medical profession: "I swear by Apollo the physician, by Aesculapius, Hygeia, and Panacea, and I take to witness all the gods, all the goddesses, to keep according to my ability and my judgment the following Oath:

"To consider dear to me as my parents him who taught me this art; to live in common with him and if necessary to share my goods with him; to look upon his children as my own brothers, to teach them this art if they so desire without fee or written promise; to impart to my sons and the sons of the master who taught me and the disciples who have enrolled themselves and have agreed to the rules of the profession, but to these alone, the precepts and the instruction. I will prescribe regimen for the good of my patients according to my ability and my judgment and never do harm to anyone. To please no one will I prescribe a deadly drug, or give advice which may cause his death. Nor will I give a woman a pessary to procure abortion. But I will preserve the purity of my life and my art. I will not cut for stone, even for patients in whom the disease is manifest; I will leave this operation to be performed by practitioners (specialists in this art). In every house where I come I will enter only for the good of my patients, keeping myself far from all intentional ill-doing and all seduction, and especially from the pleasures of love with women or with men, be they free or slaves. All that may come to my knowledge in the exercise of my profession or

outside of my profession or in daily commerce with men, which ought not to be spread abroad, I will keep secret and will never reveal. If I keep this oath faithfully, may I enjoy my life and practice my art, respected by all men and in all times; but if I swerve from it or violate it, may the reverse be my lot."

M. B. C.

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**HIPPOCRENE.** See MUSES.

**HIPPODAMIA.** See PELOPS.

**HIPPOLYTE**, in ancient Greek legend, the queen of the AMAZONS. The 9th labor of HERCULES was to secure her girdle for the daughter of Eurystheus. Routing the Amazons in battle, Hercules seized the girdle from Hippolyte's dead body. Another tradition is that she led her Amazons in an invasion of Attica, but was defeated by THESEUS, the king, who married her.

**HIPPOLYTUS**, in Greek story was the son of THESEUS by HIPPOLYTE of Antiope. Having been unjustly accused of an attempt on her virtue by his stepmother PHAEDRA, he was cursed by his father, who called upon Poseidon to destroy him. As he was driving along the seashore near Troezen, Poseidon sent a sea monster which so terrified his horses that he was dragged along and killed. Afterward his innocence was proved to Theseus. Italian tradition holds that Artemis restored him to life, and placed him under the care of the nymph EGERIA in Latium.

**HIPPOTAMUS**, a large African artiodactyl mammal belonging to the same suborder as pigs. The bulky body may reach a length of 12 feet or more, a height of four and a half or five feet at the shoulders, and weigh over 8,000 pounds. The legs are very short and thick; the head enormous, with an angular and expanded muzzle; the body deep so that when the animal walks on soft mud the under surface touches the ground. The tail is short and compressed, the eyes small but projecting, the ears rounded; both ears and nostrils can be closed at will. Each foot bears four toes, partly webbed, which are almost equal in size, and all touch the ground in walking; the central toes have not their inner surface flattened, as in the pigs. The skin is nearly naked, bearing only a few bristles. The mouth is huge, and as regards the teeth, the canines are well developed, and continue growing throughout life. Formerly widely distributed throughout the rivers and lakes of Africa, the common hippopotamus, *Hippopotamus amphibius*, is now restricted in its range.

The hippopotamus is essentially an aquatic animal spending most of its time floating at the surface, or walking about at the bottom of the water, rising at intervals to breathe. It is nocturnal in habit, being



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**Hippopotamus, an African aquatic animal**

drowsy and languid during the day, but at night leaving the water to graze on the banks. In cultivated regions these animals often cause great damage to crops. The diet is purely vegetarian. Usually only one calf is produced at birth, and is carried by the mother on her back. The hippopotamus lives well in captivity,

and can be readily induced to breed. It is hunted for the sake of the hide, which is of enormous thickness, and for the fat, but the ivory of the tusks is now little esteemed. The flesh is much appreciated by the natives who in some places hunt the animal with harpoons, as was done by the ancient Egyptians. In West Africa the pygmy or Liberian hippopotamus, *Choeropsis liberiensis*, is found. This species is about two and a half feet high and weighs 400 pounds. It is less aquatic in its habits than the common form and seems to inhabit swamps and dense forests.

**HIPPURIC ACID**, benzamido-acetic acid,  $C_6H_5CONHCH_2COOH$ , occurring in the urine of the Herbivora and under certain conditions in human urine. It is a colorless, crystalline solid, dissolves readily in hot water, and has a slightly bitter taste. It may be prepared synthetically by heating benzoic anhydride with glycolicoll.

**HIPPURITIDAE**, a group of fossil lamellibranchs, which are peculiar to Cretaceous strata. The two valves of the shell were dissimilar, the lower (right) valve being large, often conical or cup shaped, while the smaller (left) valve was flattened, small, and served as a lid to close the orifice of the cavity in the other. The hinge was large and strong, with powerful teeth, and large, prominent ridges for the attachment of the muscles. The shells were mostly attached to the subjacent rocks by the apex of the under valve, and were often a foot or more in length. Moreover, the interior cavity was more or less filled up by a mass of spongy, calcareous tissue, resembling the cells of a honeycomb. The outer surface was ornamented with ridges and furrows.

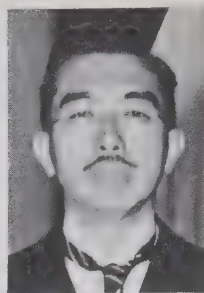
**HIRADO ISLAND**, Japan, Nagasaki Prefecture, lying immediately off the NW coast of Kyushu Island. The island is about 19 miles long and six miles wide. The towns of Hirado on the north end and Shishigi on the south, are connected by highway. In the 13th century A.D. Hirado was occupied by the Mongols in their abortive attempt to invade Kyushu. In the 15th century it was an important emporium for trade with Ming China. The Portuguese had a trading post here in the 15th and 16th centuries. In the 17th century Hirado was the site of the original Dutch trading post (factory), and in the same period the English traded here for a decade. The noted Jesuit Xavier proselytized in Hirado in the 16th century. It was famous in the 17th and 18th centuries for its production of blue and white porcelain, and its kilns are still active.

**HIRAM COLLEGE**. See COLLEGES.

**HIRATSUKA**, city, Japan, Honshu, Kanagawa Prefecture, on the Gulf of Sagami, 32 miles by rail SW of Tokyo. One of the earliest modern explosives factories in Japan was erected here by British interests. During World War II Hiratsuka was almost half destroyed by the bombs of American superfortresses. Pop. (1946) 41,359.

**HIROHITO**, 1901–, 124th emperor of Japan, was born in Tokyo, the son of Emperor Yoshihito and Empress Sadako, daughter of Prince Kujo. He was tutored privately by General Nogi and Admiral Togo, and educated at the Peers' School. By 1920 he was major in the army and lieutenant commander in the navy. In 1921, the year of his precedent-breaking trip to Europe, he was appointed regent for his father, whom he succeeded in 1926. In 1924 Hirohito married Princess Nagako Kuni, who bore him two sons and five daughters.

In 1928 when he was formally seated on the throne, he chose the name Showa, or Enlightened Peace, for his reign. Hirohito appeared for many years to



U.S. SIGNAL CORPS

Hirohito

be an enlightened, democratic emperor; but in 1931 he countenanced the invasion of Manchuria, in 1937 that of China, and in 1941 the bombing of Pearl Harbor. After the surrender of Japan to the United States in 1945, Hirohito was retained as ruler, though subject to General MacArthur's authority. In his annual New Year's message in 1946 he officially disclaimed his divinity. The 1947 constitution removed his authority, but left him ceremonial functions. In 1948 ex-Premier

Hideki Tojo absolved Hirohito from participation in war crimes while facing similar charges himself. A decision had been announced in 1947 not to charge the emperor with war crimes. See JAPAN, History.

**HIROSHIGE, ANDO TOKUTARO**, 1797–1858, Japanese artist, was born in Tokyo. He became a pupil of Toyohiro, who was one of the first of the Japanese artists to depict phases of contemporary life, domestic incidents, and native scenery. Hiroshige took advantage of a popular interest in scenery to develop a new art of landscape representation. His first experiment was to print his illustrations on separate sheets instead of binding them in books and secondly he began to use color in place of the familiar black and white. As a portrayer of mists, rains, and snows Hiroshige is marvelous and in the opinion of many has never been surpassed. Among his best works are the "Yedo Hyakku," 100 views vividly portraying the scenery of Yedo (Tokyo), the 53 views of "Tokaido," 36 views of Mount Fuji, eight views of Omi, and studies of flowers, birds, and fish. See JAPANESE ART.

**HIROSHIMA**, city, Japan, Honshu, capital of Hiroshima Prefecture, situated on an island-studded bay of the Inland Sea; target of the first ATOMIC BOMB used in warfare. Near by is the beautiful Miyajima (Shrine Island), on which is the Itsukushima (Island of Light) shrine dedicated to the goddess Benten and which is also famed for its *torii* (Shinto gates) standing in the sea. Hiroshima is the ancestral home of many Americans of Japanese descent because it was from this district that more Japanese emigrated to the United States than from any other during the time such immigration was permitted. Hiroshima is



U.S. NAVY PHOTO

Ruins of Hiroshima after explosion of the first atomic bomb



a highway and railway junction and a trade center. Products include textiles, machinery, tools, rubber goods, bronze and lacquer ware, and synthetic petroleum. Rich oyster beds are nearby.

Hiroshima was of military importance during the first Sino-Japanese War and World War I. In World War II the first atomic bomb was dropped on this city Aug. 6, 1945, by a U.S. plane. This action, and the atomic bombing of Nagasaki three days later, brought quick capitulation by Japan. A U.S. survey of the effects of the Hiroshima bombing showed that 70,000 to 80,000 persons were killed or missing and 70,000 were injured; 62,000 out of some 90,000 buildings were destroyed and 6,000 were severely damaged. In the decade after 1945 great strides were made in the redesign and reconstruction of the city, but although more homes were built in Hiroshima than in any city in history during a comparable period, housing was still inadequate, owing to a large increase in population. Pop. (1950) 258,712.

**HIRSAU**, village and health resort, Germany, in the state of Württemberg, situated in the N part of the Black Forest, on the Nagold River, two miles N of Kalw. The village is noted as the site of the formerly important Benedictine monastery, *Monasterium Hirsauense* (ninth century), which was secularized in 1558 and destroyed in 1692. Between 1071 and 1091, the monastery rose to importance under Abbot Wil-

and the Bober rivers, 50 miles by rail SSW of Liegnitz (Lignica). Features of interest include an 18th century town hall; an 18th century Protestant church; and a 14th century Roman Catholic church. Glass and wood wares, machinery, paper, cement, linens, laces, cottons, chemicals, and liqueurs are manufactures. Hirschberg was founded late in the 13th century, becoming a town in 1312. In 1368 it became Bohemian; in 1741, Prussian; and in 1945, after the end of fighting in Europe, it was transferred to Poland. Pop. (1952 est.) 38,000.

**HISPANIA**. See SPAIN.

**HISPANIC SOCIETY OF AMERICA**, an organization founded in 1904 for the presentation in America of the culture of the Hispanic peoples. Beginning with a small private collection, the society has developed a library and museum in New York City containing large collections of work by Spanish and Portuguese artists. Among its exhibits are paintings, sculpture, goldwork and silverwork, ceramics, furniture, textiles, maps, manuscripts, and books. Over 600 volumes on Spanish art and literature have been issued by the organization. Membership in the society is honorary and is limited to 100 regular members and 300 corresponding members.

**HISPANIOLA**, an island in the West Indies, lying E of Cuba and W of Puerto Rico. HAITI occupies the western one-third of the island and the DOMINICAN

REPUBLIC, the eastern two-thirds. Discovered by Columbus in 1492, the island was named Española, although Haiti was the native name. Later, the island was called Santo Domingo by the Spaniards and Saint Domingue by the French, names used interchangeably with Haiti to designate the entire island. The favored name is now Hispaniola.

**HISSAR**. See AFYON KARAHISAR.

**HISTAMINE AND ANTI-HISTAMINE DRUGS**.

Histamine is important as a drug and also as a suspected "villain" of various allergic conditions such as hives, asthma, hay fever, and serum sickness. Histamine ( $C_5H_9N_3$ ) is a decomposition product of histidine (one of the essential AMINO ACIDS) and is normally

present in many animal and human tissues. Also present in the tissues is an enzyme (*histaminase*) that acts, though exceedingly slowly, to destroy histamine.

**Action**. When injected in very small amounts histamine stimulates involuntary muscle, particularly that of the bronchi, stomach and intestines, gall bladder, and uterus. It also increases secretory activity, especially of the salivary glands, stomach, and pancreas. In somewhat larger doses it causes a fall of blood pressure, which is due to the dilatation and engorgement of the capillary bed and also to the fact that a large part of the circulating blood stagnates in the capillaries and does not return to the heart. When histamine in dilute solutions is applied to the scarified skin or driven into the skin by electric current, it produces a fiery redness of the part followed by wheal formation (see SKIN). The local redness is accompanied by a diffused flare that depends upon the integrity of small nerve fibers in the vicinity.

**Use in Diagnosis**. Local application of histamine helps to differentiate between patients who are over-sensitive to histamine and those who react normally to it; to emphasize abnormal skin pigments; and to test the integrity of certain nerve fibers in the skin. Injection of a very small dose of histamine helps to



EMBASSY OF THE DOMINICAN REPUBLIC

Cathedral of Santo Domingo on the Island of Hispaniola

helm von Hirsau, d. 1091, who, in imitation of the Cluny reforms, formed a new religious order, *Constitutiones et consuetudines Monachorum Hirsauensium*, which spread throughout Germany. History of the monastery is included in *Chronicon Hirsauense* (1514), by Abbot Trithemius, 1462–1516, a volume which also covers German history from 830 to 1370. The book appeared as *Annales Hirsauenses* at St. Gallen in 1690. *Codex Hirsauensis* (1843), edited by A. F. Gfrörer, is important as local history. Pop. (1950) 1,600.

**HIRSCH, MAURICE, BARON DE**, 1831–96, Jewish philanthropist was born in Munich. He devoted his vast fortune, partly inherited and partly acquired by fortunate speculation, to schemes for the betterment of his race. To the *Alliance Israélite Universelle* he presented \$400,000, and endowed it with \$80,000 a year. For the benefit of persecuted Jews he founded in 1882 the (English) Jewish Colonization Association, with a capital of \$10,000,000, and in 1892 he gave it an additional \$35,000,000. The association has founded colonies of Russian Jews in Canada, South America, and Asiatic Turkey.

**HIRSCHBERG**, Polish *Jelenia Góra*, town, Poland, in the province of Slask, near the N foot of the Riesengebirge, at the confluence of the Zacken

distinguish functional (nervous) gastric disorders from those due to organic disease (see INDIGESTION). The marked increase in acidity and volume of the gastric juice produced in response to histamine does not occur in patients whose low stomach acidity is the result of organic disease.

**Medical Uses.** Slow intravenous injections of extremely dilute solutions of histamine often stop or improve the nausea, dizziness, ringing in the ears, and even deafness of Meniere's disease. Dramatic relief of the type of HEADACHE called histaminic cephalalgia has also been obtained by repeated administration of small but gradually increasing doses of histamine. This procedure is called *histamine desensitization*, the idea being that if an individual can be made tolerant to increasingly larger amounts of histamine, he will also acquire resistance to the histamine released from his own tissues. Histamine desensitization has been tried in many allergic conditions but the results have not been entirely satisfactory.

**Significance of Histamine in Disease.** Histamine or histamine-like materials have been suspected of being the poisonous factors in a long list of injuries and pathological conditions, including shock, peptic ulcer, "autointoxication," and the toxemias of pregnancy. This wholesale indictment of histamine is not always justified by the available evidence. It does appear, however, that histamine is a prominent, perhaps the most important, cause of anaphylaxis (see VACCINES AND SERUMS). During acute anaphylactic shock, i.e., following injection of a shock-producing dose of horse serum to sensitized dogs, there appears in the blood and lymph a substance that contracts the intestinal musculature and lowers blood pressure in experimental animals and produces wheals on the scarified human skin. As far as is known only histamine can accomplish all these things. Furthermore it is known that the liver is the "shock organ" in the dog; that is to say, the liver plays the main part in the causation in the anaphylactic phenomena. Liver histamine is suddenly decreased during canine anaphylaxis, indicating an abrupt release of this substance into the circulation. Experiments with other animals are similarly convincing.

**New Hope for Victims of Allergy.** The close relationship between anaphylactic shock and the various human allergies suggests that the symptoms of most allergic diseases, such as hives, hay fever, asthma, sensitivity to cold water, and histamine headache, are associated with release in the tissues of histamine or histamine-like substances (see ALLERGY). It is postulated that the type of allergic reaction experienced by a particular individual depends on where the histamine is released and where the tissue hypersensitive to it is located. The evidence that histamine is the chief villain of allergies is by no means complete, but it is significant that drugs that antagonize the action of histamine in experimental animals also prevent anaphylactic shock and bring relief to many victims of allergy. Of these drugs, the most promising are members of two groups of chemicals, the *benzhydryl ethers* and certain *aminopyridine* derivatives. These drugs, which can be taken by mouth, do not cure allergy but merely give relief during the course of medication. The symptoms of the specific disease are likely to reappear after discontinuation of the therapy.

**Benadryl**, the most famous of the benzhydryl compounds, antagonizes the action of histamine on the blood pressure and smooth muscle. In addition it enhances the effects of ADRENALINE and, like ATROPINE, annuls the effect of acetylcholine. Thus with its anti-histamine action it combines effects resembling those of ephedrine and belladonna, which are probably responsible in part for its effectiveness in human allergies, as it is well known that these two drugs will bring some relief to allergy victims. Benadryl is particularly useful in the treatment of hives; in one study two-thirds of the patients suffering acute attacks were relieved promptly, while the majority of the

chronic cases experienced complete or nearly complete disappearance of symptoms. Benadryl has been reported to give partial or complete relief to almost 70 per cent of patients suffering from hay fever. Asthma patients are least likely to benefit from benadryl. Allergic headaches and rhinitis appear to react very favorably to this drug. Apparently about 60 per cent of all allergy patients can expect to receive marked benefit from benadryl. Untoward reactions to benadryl have been reported in slightly more than 50 per cent of the patients. They are of mild degree and include sleepiness, dizziness, blurring of vision, general weakness, and dry mouth (belladonna action). These symptoms disappear promptly upon discontinuing the drug or decreasing its dose.

**Pyribenzamine** counteracts in experimental animals the effect of histamine on the intestines, bronchi, blood pressure, salivation, and wheal formation. It prevents the occurrence of anaphylactic phenomena in guinea pigs and dogs. It also has some local anesthetic action and, like COCAINE, enhances adrenaline action. Unlike benadryl it has no belladonna-like effects. Pyribenzamine has been reported to produce marked improvement or cessation of symptoms in 73 per cent of all allergic cases. It is particularly effective in seasonal hay fever caused by ragweed, in hives, and in bronchial asthma. Only 4.4 per cent of the patients studied experienced untoward reactions sufficiently severe to warrant discontinuation of the drug, and apparently 70 per cent of the patients were not in the least inconvenienced. The side-actions of pyribenzamine are similar to those of benadryl and include drowsiness, dizziness, headache, and nausea, but not dry mouth.

Since 1920 antihistamines have been widely advertised and used for relief of the common cold; but their effectiveness is a subject of controversy, and their indiscriminate use may cause severe reactions. See COLD. THEODORE KOPPANYI

**HISTIDINE.** See AMINO ACID.

**HISTOLOGY**, the science which deals with the minute anatomy of organisms. See ANATOMY; ORGANS AND TISSUES; PLANT STRUCTURE.

**HISTORICAL ASSOCIATION, AMERICAN**, a learned society that was organized Jan. 4, 1889, at Saratoga, New York, for the promotion of historical research and study.

Its publications include *The American Historical Review*; *Social Education*, in co-operation with the National Council for Social Studies; and the Association's *Annual Report* to Congress, in one or two volumes and containing the *Proceedings*.

Annual meetings are held during Christmas week and are the occasion for presentation of papers by the foremost historians in the United States on a variety of subjects of interest to the members.

To encourage historical research, the Association presents annual awards for historical works by American authors judged the best of the year. As a result the American Historical Association has had considerable influence in the stimulation and publication of historical research.

Membership of the Association in 1951 was 5,700. Headquarters of the American Historical Association are located in the Library of Congress Annex, Washington, D.C. See AMERICAN COUNCIL OF LEARNED SOCIETIES.

**HISTORICAL ASSOCIATIONS.** There are hundreds of organizations in the United States devoted to the study of history or the preservation of records and other items of historic interest. The majority of these organizations are in New England, the Middle Atlantic states, and the Middle West, with well over half of the total number of historical societies located in these areas combined. Comparatively few historical associations are found in the southern states or in the states which are located west of the Mississippi River.

**National.** A few historical societies are national



SOME OUTSTANDING NATIONAL HISTORICAL ASSOCIATIONS

| NAME                                          | HEADQUARTERS      | MEMBER-SHIP * | PUBLICATIONS                                                                                                 | SPECIAL FIELD                                                |
|-----------------------------------------------|-------------------|---------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Agricultural History Soc.                     | Washington, D.C.  | 600           | <i>Agricultural History</i>                                                                                  |                                                              |
| Am. Antiquarian Soc.                          | Worcester, Mass.  | 200           | <i>Proceedings</i>                                                                                           |                                                              |
| Am. Assoc. for State and Local History        | Washington, D.C.  | 950           | <i>State and Local History News; Historical Societies in the United States and Canada; American Heritage</i> |                                                              |
| Am. Catholic Historical Assoc.                | Washington, D.C.  | 850           | <i>Catholic Historical Review</i>                                                                            |                                                              |
| Am. Historical Assoc.                         | Washington, D.C.  | 5,772         | <i>American Historical Review</i>                                                                            |                                                              |
| Am. Jewish Historical Soc.                    | New York, N.Y.    | 1,300         | <i>Publications</i>                                                                                          | Am.-Jewish history                                           |
| Am. Military Institute                        | Washington, D.C.  | 956           | <i>Military Affairs Journal</i>                                                                              | Warfare                                                      |
| Am. Philosophical Soc.                        | Philadelphia, Pa. | 1,346         | <i>Proceedings; Memoirs; Transactions; Yearbook</i>                                                          | Foreign scientific periodicals; American science and culture |
| Am. Scenic and Historic Preservation Soc.     | New York, N.Y.    | 250           | <i>Scenic and Historic America</i>                                                                           | Alexander Hamilton collection                                |
| Am. Swedish Historical Foundation             | Philadelphia, Pa. | 1,000         | <i>Yearbook</i>                                                                                              | Swedish-American history; Jenny Lind                         |
| Business Historical Soc.                      | Boston, Mass.     | 900           | <i>Bulletin</i>                                                                                              | History of American business                                 |
| Church Historical Soc.                        | Philadelphia, Pa. | 784           | <i>Historiographer</i>                                                                                       | History of Protestant Episcopal Church                       |
| Friends Historical Assoc.                     | Haverford, Pa.    | 636           | <i>Bulletin</i>                                                                                              |                                                              |
| Marine Historical Assoc.                      | Mystic, Conn.     | 2,500         | Marine and sailing books                                                                                     | Whaling, shipping, and marine life                           |
| Mississippi Valley Historical Assoc.          | Lincoln, Neb.     | 1,200         | <i>Proceedings; Mississippi Valley Historical Review</i>                                                     |                                                              |
| Naval Historical Foundation                   | Arlington, Va.    | 862           | Booklets                                                                                                     | Naval history                                                |
| New Eng. Historic Genealogical Soc.           | Boston, Mass.     | 2,700         | <i>New England Historical and Genealogical Register</i>                                                      | American genealogy, biography                                |
| Norwegian-Am. Historical Assoc.               | Northfield, Minn. | 1,070         | <i>Studies and Records Publications; Travel and Description Series</i>                                       | Norwegian-American history                                   |
| Presbyterian Historical Society               | Philadelphia, Pa. | 150           | <i>Journal</i>                                                                                               | Ecclesiastic and Presbyterian History                        |
| Railway and Locomotive Historical Soc.        | Boston, Mass.     | 1,000         | <i>Bulletin</i>                                                                                              | Railway development and transportation                       |
| Soc. for Preservation of New Eng. Antiquities | Boston, Mass.     | 1,800         | <i>Old-Time New England</i>                                                                                  | History of New England; glass, china                         |
| Soc. of Descendants of Colonial Clergy        | Lancaster, Pa.    | 264           | <i>Colonial Clergy and Colonial Churches of New England</i>                                                  | Colonial churches and colonial clergy                        |
| Southern Historical Assoc.                    | Raleigh, N. C.    | 1,627         | <i>Journal of Southern History</i>                                                                           |                                                              |

\*1951

organizations. Most of these are devoted to the study of a particular branch of history, for example, that of a particular religious or nationality group. Libraries and museums are often maintained by them and in many cases bulletins and other publications are issued. The accompanying table lists the chief national organizations.

**State.** State and local historical societies are usually chiefly concerned with the history of their own geographical regions. In many parts of the country official state historical societies are responsible for keeping the historical records of the state. Among those states which have historical associations supported wholly or in part by legislative appropriations are: California, Colorado, Idaho, Indiana, Kansas, Kentucky, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Dakota, Utah, Vermont, Washington, and Wisconsin. In addition there are a number of state historical societies which do not receive support from public funds. All of these organizations usually maintain museums and libraries and publish informative material about their states.

In many states the keeping of official historical

records is entrusted to the archives or history department of the state government. Among the states using this system are Alabama, Arizona, Delaware, Georgia, Illinois, Iowa, Louisiana, Mississippi, North Carolina, Rhode Island, Virginia, Washington, West Virginia, and Wyoming. In addition a number of states maintain historical commissions for specific purposes, such as the preservation of historic sites and the erection of historic markers. Such commissions exist in Arkansas, Michigan, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia.

**County and City.** Among local historical societies county associations are particularly numerous. These are often partially supported by county appropriations as well as by member dues and often maintain large memberships. These groups are almost always concerned with the history of the immediate locality and often publish detailed histories of their counties. In addition there are large numbers of city historical societies and other associations organized by particular groups or for specific interests. See HISTORICAL ASSOCIATION, AMERICAN.

C. F.

**BIBLIOG.**—American Association for State and Local History, *Handbook of Historical Societies in the United States and Canada*.



*First by word of mouth, then in writing,  
man passed on the deeds of his day, for  
the education and enjoyment of posterity*

**HISTORY** originally denoted all acquired knowledge; next, a record of facts which had become known to the writer from his personal experience and observation; and finally, it was extended so as to include facts communicated to him by trustworthy and credible witnesses. As at present understood and applied, it has come to include, besides political events, the movements which belong to religion, law, literature, economics, social customs, and everything that affects the society of man.

**The Earliest Records**, whether sacred or profane, are lists or tables giving the succession and genealogies of ruling dynasties. Subsequently they begin to include dates of great military expeditions, treaties made with other nations, and payments of tribute. A further stage is reached when they are found incorporating annals of the court, or events relating to foreign policy. Associated, however, as such records mostly are, with a despotic or an aristocratic form of government, they contain little that serves to illustrate the inner life of the people. The books of **KINGS** and of **SAMUEL** in the Old Testament, written in the 7th century B.C., and the books of **Chronicles**, compiled some three centuries later, are the most notable examples of expansion from the meager beginnings above described into something more nearly corresponding to what is now termed history. Similar records are the fragments of Egyptian history preserved by Manetho, which belong to the third century B.C.; and such, again, are the primitive records of the Chinese and Japanese people.

**Herodotus and Thucydides**. Another stage is reached when the record assumes the form of a continuous narrative, spontaneously undertaken by the author. Of such literature ancient Greece affords at once the earliest and the most noteworthy examples. Commencing with Hecataeus (550-476 B.C.) of Ionia and his fellow logographers, we find in the fifth century (about halfway between the appearance of the books of **Kings** and those of **Chronicles**) the two contemporary writers, **HERODOTUS** of Halicarnassus and **THUCYDIDES** of Athens, compiling their respective histories. But while Herodotus justifies his claim to be called "the father of history" by his singular genius for historic narrative, keen observation of social phenomena, and the fairness with which he holds the balance between Persian and Greek, his limited perception of the underlying causes of the events which he describes lead some to assign him a place below that claimed by general assent for his illustrious contemporary. In Thucydides the absolute candor and impartiality of the writer in his presentment of the facts, his deep insight into the significance of events and into the laws which operate on human motives, together with the rigorous abstention from any direct expression of his own political views, combine to form a high standard of historical excellence. The attempt

## History

of **XENOPHON**, in the first two books of the *Hellenica*, to continue the narrative was an effort beyond his powers. As a writer, indeed, he reminds us more of Herodotus than of Thucydides; and his literary fame rests chiefly on his *Anabasis*, a classic example of simplicity and self-restraint in military narrative. On **POLYBIUS** (204-122 B.C.), commanding a historic retrospect unattainable by the foregoing writers, it first developed to shadow forth a philosophy of history. He appears to have discerned with remarkable sagacity the chief lessons to be derived from human experience, whether in Hellas or elsewhere, down to his time. Greek though he was, he could recognize in the subjugation of his people by Rome the result of general and inevitable loss. As Carthage had fallen, so the Macedonian Empire fell. In the forces discernible as operating in the past, Polybius found an adequate explanation of the revolution in process in his own day.

**Latin Historians** offer no example of originality comparable with the foregoing; but **LIVY** (59 B.C.-A.D. 17) and **TACITUS** (A.D. 55?-117) are examples of a high order of historical composition—the former, though not reliable from a critical point of view, was distinguished by his singular command of the Latin language and animated portraiture of character; the latter, by his pregnant sentences, mastery of condensed expression, and by his singular insight into the mainsprings of human action. Two other famous Latin historians were **SALLUST** (86-34 B.C.) and **SUETONIUS** (c. A.D. 75-130). Although what they wrote was not history in the modern sense, their works must be considered important sources of our knowledge of Roman history. Sallust's *Conspiracy of Catiline* and *The Jugurthine War* were political pamphlets, yet, conceived in a brilliant style, they give a deep insight into the workings of Roman policy during the last century of the Republic. Suetonius' *Lives of the Twelve Caesars* presented unique studies of a tyrant's character. His portraits of the Roman rulers from Caesar to Domitian are an invaluable record of that period.

Although, however, the sense of a common Roman citizenship undoubtedly discouraged manifestations of national rivalry and exclusiveness, there was probably no time in which historical license was carried to greater lengths than in the days of **LUCIAN** (A.D. 120-200) of Samosata. It was the time, moreover, when invention and legend, both pagan and Christian, were especially called into requisition in order to afford support to the opposing theories of the two contending parties with respect to the calamities which were then befalling the empire. From such superstition the best philosophy of the time stood contemptuously aloof; but Lucian, who has rarely been surpassed in subtle observation, whether of social characteristics or of political affairs, was induced to propound a new theory of the obligations incumbent on the historian, by writing his famous treatise, *How History ought to be written*.

Lucian commences by insisting on the fact that history is *not* "one of the things which it is easy to deal with," but all literary labor is the kind which demands the largest expenditure of careful thought, if indeed the outcome is to be, as Thucydides had expressed it, something valid "for all time." He proceeds, accordingly, to enunciate certain canons, the observance of which he considers indispensable if the function of the historian is to be adequately discharged. As regards the writer himself, he holds that he must be possessed of a natural power of discernment in political affairs, an adequate faculty of literary exposition, and a complete freedom from motives of self-interest, whether it be a dread of giving offense or a hope of reward. As regards the narrative itself, the language must be clear and plain, and all rhetorical ornament carefully eschewed, the sole aim being to state facts as they actually occurred. The writer must also be perfectly candid, panegyric and satire being equally shunned; neither the errors of distinguished leaders nor the gravest disasters attending his country's arms



are to be palliated or concealed. "To truth alone must he offer sacrifice, fearless, incorruptible, untrammelled, conceding nought either to hate or to friendship, a citizen of no city, recognizing allegiance to no ruler, and setting forth the results of his researches in a diction which the many may understand and the more educated approve."

**Augustine.** Writing at a time when the imperial power of Rome was at its culminating point, Lucian exulted in the empire's greatness; and his point of view is that of an enlightened and philosophic paganism, by which Christianity, as yet scarcely known by name, was very imperfectly apprehended. A century and a half later Christianity had become the religion of the state; and when in 410, Rome fell before Alaric, there were those among the pagan writers who presumed again to raise the cry which had been heard in the days of Marcus Aurelius, and to declare that the woes of the Roman world were a heaven-sent visitation, and could only be interpreted as a manifestation of the displeasure of the gods at the repudiation of their worship for that of the God of the Christians. It was in answer to such allegations that AUGUSTINE of Hippo, between the years 413 and 426, compiled his treatise, *De Civitate Dei*. He insists on the descent of all mankind from Adam, and on the results of the fall as manifest in the permanent division of humanity into two diametrically opposed elements—the two cities, as he terms them—the one, that of the Christian, swayed by the love alike of God and man, and destined eventually to become the city of the New Jerusalem; the other, the embodiment of the sin, the error and the darkness which the Christian state has been called into existence to combat, vanquish, and ultimately exterminate. See CITY OF GOD.

The influence exercised by Augustine's treatise on subsequent historical speculation can scarcely be overestimated, a result to which the abridgment drawn up by his devoted disciple Orosius largely conduced. In this compendium, the latter, by his teacher's express direction, gave especial prominence to the calamities and sufferings consequent upon war and hostile invasion, which, long prior to Christian times, had befallen the nations of antiquity, and had been marked by deeds of yet greater cruelty than Alaric's; and he is at special pains to point out that the leader of the Goths, overruled in purpose by the God of the Christians, had spared the treasures of the Vatican, while he challenges his opponents to show that the gods of paganism had ever been able to extend like protection to their own shrines.

**The Middle Ages.** The mental attitude of medieval scholars and writers will indeed be but imperfectly understood if we fail to bear in mind that the abridgment by Orosius was the manual of profane history exclusively used by the teachers of the schools of Western Christendom throughout the Middle Ages. Estimated from this point of view, all pagan history came to be regarded as worthless. Even the history of Greece was well-nigh forgotten, along with the greater part of the Hellenic literature; while Roman history survived mainly through its association with the revived study of the Roman law. And thus, of general history, of ancient empires and Oriental civilizations, little more was known than was to be gleaned or inferred through the medium of the theory set forth by the bishop of Hippo. The influence exerted by Augustine in connection with historical teaching must therefore be regarded as retrogressive. In every great conflict whereon vast national interests depended, the appeal to the God of battles, as the supreme arbiter of the fate of nations, was generally present to the minds of the majority of the combatants.

Even Philip de Comines (1455–1509), a writer indisputably in advance of his time, and distinguished alike by his natural sagacity and knowledge of political affairs, does not hesitate to assert that the battle, rightly regarded, is an appeal to Heaven, and depends for its issue not so much on diplomatic force-

sight, competent generalship, and adequate, well-trained forces, as on the fiat of an overruling Power. The historical writers of each successive period, strongly convinced of the truth of this theory, and aiming, for the most part, at upholding the fame of their respective countries, necessarily became strong partisans. They not only accepted and maintained the general, the universal belief in a supreme Providence, with whom, when human agency has done its best, the final issue must abide, but they assumed that they themselves were endowed with the faculty which enabled them to recognize in each more momentous event the intervention of the supernatural.

**Renaissance.** As, however, the 15th century advanced, three great events combined gradually to bring about a marked advance in historic theorization: the revival of Greek learning brought back to Western Europe a fuller knowledge of the literature of antiquity; the invention of printing, by abbreviating the labor and facilitating the researches of the scholar, generated a rapid interchange of ideas which stimulated inquiry on every subject; the discovery of the New World compelled the philosopher to take account of elements in humanity not included in the survey of any medieval thinker. The main stream of historical literature, indeed, continued much as before, for the most part uncritical in investigation, reflecting only the traditional conceptions, and even appearing at a disadvantage when contrasted with such medieval writers as William of Malmesbury, Otto of Freising, and Rahewin and Matthew of Paris. But, side by side, a more inquiring spirit is to be found.

In Germany, the career and writings of Pirkheimer (1470–1530) mark a notable innovation. His Latin *History of the Swiss War*, which gained for him the title of "the German Xenophon," is distinguished by its lucidity and impartiality, and is referred to by Ranke as a good example of the great superiority perceptible in such narratives when grounded upon personal experience and observation.

**Reformation.** The Renaissance had rendered immense service to the cause of historic truth by the more critical spirit which it engendered, and by the consequent exposure of numerous medieval forgeries, such as the *Donation of Constantine*, the pretended *Decretals of Isidore*, and the writings attributed to Dionysius the Areopagite. But the Reformation in Germany, although originating in a like spirit, resulted in the appearance of two rival schools of theology, whose champions utilized the study and writing of history to bolster their arguments. But if the spirit of sectarianism gave rise to highly colored interpretations of history, it at the same time imparted fresh stimulus to the study. In the same year that the centuriators of Magdeburg brought their labors to a conclusion, there was published at Basel a volume of short Latin treatises, 18 in number, each dealing with the subject of history in general, or setting forth the method by which it could best be treated as a branch of learning. None of these treatises, however, can be regarded as of permanent value; but in the meantime the Frenchman Jean Bodin (1530–96), the author of the famous *Republic*, published in 1566 his *Method of easily attaining to the Knowledge of History*. That the first concern of the student of history is with mankind—with himself, that is to say, and the world around him—that a knowledge of cosmography and of the influences of climate is essential to a right apprehension of universal history, and that an insight into religious truths and the operation of divine laws will be materially aided by a comparative study of religions, were novel and startling theories in the second half of the 16th century. Bodin's 10th chapter is interesting from the fact that it contains a list of the historical writers at that time in print.

De Thou or Thuanus (1553–1617), the eminent minister of Henry IV of France, in his *History of his Own Time*, exhibits a judicial impartiality which seems to fall but little short of the ideal set forth by

Bodin; while his preface attests even yet more clearly the influence of Lucian's treatise.

CLARENDON'S *History of the Rebellion* (final revision, 1667-74) although a work of signal merit, is essentially an apology in defense of the royalist party. Few writers, however, have better understood both what history should and should not be. Clarendon not only lays great stress on the paramount importance of access to original documents, but takes occasion to observe that even with such aids "a man will not be enabled to write a history, if there be an absence of that genius and spirit which is contracted by the knowledge and course and method of business, and by conversation and familiarity with courts and the most active and eminent persons is the government."

In France, the famous *Discours sur l'Histoire Universelle* (1681) of BOSSUET exerted different influence. Bossuet adopted the patristic estimate of the Jewish nation and its records, and accepted, almost without qualification, the Augustinian doctrine of the world's history. He admitted, indeed, the existence of secondary causes, but by habitual reference to an overruling Power he evaded the necessity for the ascertainment of facts.

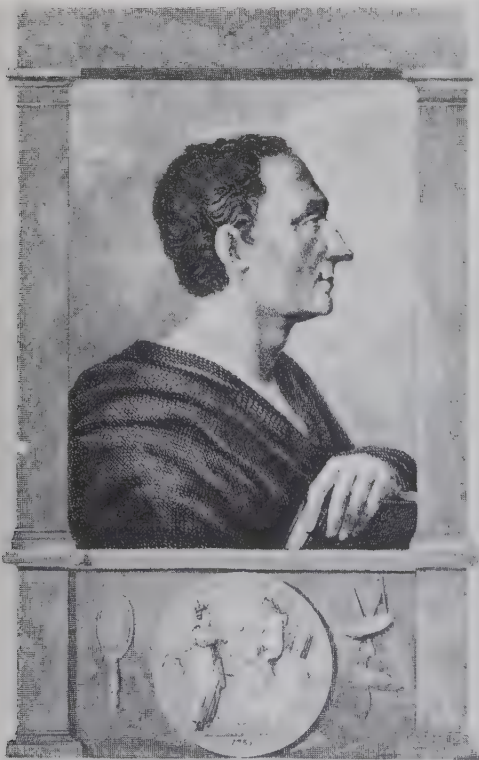
**Montesquieu, Vico, and Turgot.** After an interval of more than half a century appeared the epoch-making work of MONTESQUIEU (1689-1755), the *Esprit des Loix*. In arriving at the fundamental principles of his philosophy, Montesquieu's researches and ponderings were long and arduous, for, as he himself claimed, "they were drawn, not from my prejudices, but the nature of things." Starting with an enlarged conception of laws, he defines them as "the necessary relations resulting from the nature of things"—operative, constant, and immutable throughout creation, the chief determining causes of the course of history, compared with which legislation, great political crises,

and powerful individualities can have but a secondary and altogether subordinate influence. To discover and interpret the operation of these laws, alike in physical and social phenomena, must be the chief aim of those who seek to construct a science of history.

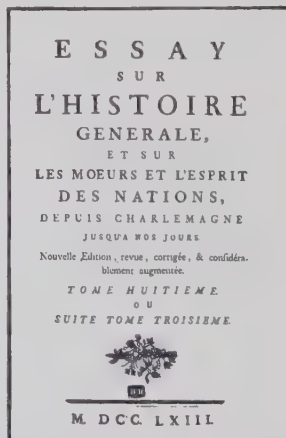
In the year 1725 appeared the *Scienza Nuova* of VICO, the Italian philosopher, wherein he propounded afresh the Platonic theory of a Divine Idea, which he held permeated all history and guided human destiny. Under its influence, the operation of which he considered to be constant and uniform, history resolved itself into cycles or recurrent periods, and thus, in a manner, repeated itself, but always with a difference.

We have no evidence that Vico's speculations had become known to TURGOT (1727-81) at the time (1750) when he delivered his two discourses at the Sorbonne; otherwise, the second discourse, entitled *Two Successive Advances of the Human Mind*, might well appear a development of the earlier writer's main theory. To Turgot it seemed that progress was the essential, the distinguishing characteristic of man, and that history was rightly its record. Each epoch, he pointed out, is linked to those which precede or succeed it by a broad sequence of causes and effects; each generation bequeaths to the next an ever-increasing legacy of experience and knowledge, which, preserved by multiplied signs of speech and writing, becomes the inalienable possession of the entire race.

**The Encyclopedists.** In his earlier discourse, *On the Advantages conferred by Christianity upon the Human Race*, Turgot, much as he differed from Bossuet, appeared as the advocate of the church, and consequently found himself in direct opposition to the new philosophical movement represented by DIDEROT (1713-84) and the ENCYCLOPEDISTS, powerfully aided by the literary activity of VOLTAIRE and ROUSSEAU. Profoundly impressed by what they considered to be the degraded condition of the masses around them and the oppression which, they held, was the main cause of that degradation, this new school regarded with avowed hostility most of the existing institutions of their country, whether ecclesiastical or political. Misgovernment, antiquated theories, wrongly directed education, were, they held, the sources of these evils, and must consequently be either abolished or reformed. But such views, although destined to exert an immense influence on the historical literature of a succeeding generation, were not derived from the study of the past. Voltaire's contempt for everything medieval passed all reasonable bounds; while, on the other hand, he signally failed adequately to recognize the genius of Montesquieu. He is entitled, however, to high praise as an historian, and his *History of Charles XII* and *Age of Louis XIV*, founded as they are on original sources, and evincing a genuine regard for accuracy and veracity, are excellent examples of historic composition. Their chief defect is the absence of any endeavor to refer back events to general or remotely operative laws; while the causes, even of the most important, are assigned now to some trivial incident, and now to the influence of some great personality.



Charles de Secondat Montesquieu, author of "L'esprit des lois," published in 1748, greatly influenced political thought in Europe and America



Title Page from early edition of Voltaire's essays, including work on "General History"

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**German Historians in the 18th Century.** In Germany, after the peace of Westphalia, the few scholars who devoted themselves to historical studies rarely did more than collect materials. Even the researches of LEIBNITZ (1646-1716), in connection with his projected *History of the House of Brunswick*, appeared only in his *Scriptores Rerum Brunswicensium* (1707-11); and his *Annales Imperii Occidentis*, extending from 768 to 1005, remained unpublished, until given to the world by Pertz in 1843-46. Among the many services rendered to learning by Leibnitz, not least was the disillusionment which he effected among philologists with regard to the real place of Hebrew among the Semitic languages. Prior to that time the belief that it was the parent tongue from whence all other languages were derived, had rendered the study of philology an inextricable maze of conjecture.

It is not until the latter part of the 18th century that any material improvement is to be discerned in Germany, when it appears as mainly due to French influences working mediately through Switzerland. Isaac Iselin (1728-82), Wegelin (1721-91), A. L. von Schlözer (1735-1809), and Johannes von Müller (1752-1809), all approached different fields of philosophical inquiry with views that were to some extent original. The *Universal History* of the last-named marks, indeed, a new departure in the treatment of so vast a subject, and takes rank as the first work of the kind, which, while exhibiting the several histories of the different nations in close connection, discriminates with accuracy the characteristic features of each. In 1784 IMMANUEL KANT published his *Ideas towards a Universal History from a Cosmopolitical Point of View*, a treatise of which Schiller's inaugural discourse delivered in 1789 (as professor of history at Jena) was little more than an echo. Kant maintains that the human will is never really free, and that even the most masterful spirits are but the unconscious instruments of an irresistible, all-pervading force working through all history. Man simply gives effect to that which nature designs. Kant held, however, that a progressive improvement in civil polity was to be discerned in Europe, and that Europe was destined to give laws to the rest of mankind; while the final cause of all history was to guide civilized communities to the development of a perfect political constitution.

**Beginnings of a Science of History.** From the time of Kant the whole conception of history becomes in Germany more complex and profound. Schelling (1775-1854) and F. Schlegel (1772-1829) each propounded a new theory, while the teaching of HEGEL (1770-1831) gave rise to the formation of an important school. Michelet, Quinet, Schwegler, Lassalle, Zeller, and Kuno Fischer all, in a greater or lesser degree, reflected Hegel's influence in their researches. F. C. Baur and Strauss applied his method in their investigations into sacred history.

Side by side with this remarkable speculative movement there was also rising up in Germany a school with widely different characteristics. In Niebuhr (1776-1831) and Savigny (1779-1861) scholarship of the highest type was to be seen in combination with great original power, a strongly national spirit, and an extensive knowledge of men and affairs. By precept and by example they alike enforced the theory that a trustworthy science of history is to be arrived at only by a series of inductions derived from accurate and exhaustive research in each particular field. By laborious study of long-disjointed fragments of evidence and a sagacious insight into the kernel of truth which lay shrouded in the "myth," NIEBUHR, in his *History of the Roman People*, reconstructed the history of the Latin race; by similar, although less conjectural methods, Savigny compiled his *History of the Roman Law in the Middle Ages*, a work which may fairly be said to have initiated the historical study of law; while the labors of both these eminent scholars may be said to have been, in a manner, reflected in the researches of Waitz (1813-86), the founder of the school which

established an organic conjunction between historical and legal studies. Scarcely less important were the services rendered by Stein (1757-1831), who, sharing in that revived spirit of Prussian nationality which followed upon the fall of Napoleon, first projected the invaluable series—the *Monumenta Germaniae Historica*—associated with the name of Pertz (1795-1876). In 1824 LEOPOLD VON RANKE (1795-1886) published his *History of the Romance and German Races from 1494 to 1514*, with a masterly criticism of the sources to which he had been mainly indebted. Toward the conclusion he pointed out certain improvements in historical investigation which he deemed essential to a genuinely scientific method. In the preface to his *History of Germany in the Period of the Reformation* (1839-40) he reverted to this latter subject, at the same time expressing his conviction that, in no long time, the duly-trained historian would cease to rely on the statements of even contemporary writers, unless derived from a first-hand knowledge of the facts, and would, as far as possible, ground his narrative solely on original documents.

**England.** Under the depressing influences of the Hanoverian rule, history declined greatly in England. The painstaking labors of Strype (1643-1737) pale beside the splendid research of Muratori (1672-1750). The reception accorded in France to Voltaire's famous *Essai sur les mœurs et l'esprit des nations* (1755) stands in marked contrast to that vouchsafed to the two first volumes of Hume's *History of England*, published at the same time. Even the undeniable merits of Robertson's *History of Charles V* (1769) bring into stronger relief the defective knowledge of earlier times betrayed in his introduction. GIBBON'S *Decline and Fall of the Roman Empire* (1766-88), has justly been characterized as "the greatest monument of historical research united to imaginative art of any age in any language." With the commencement of the 19th century the influence of German scholarship brought about a decisive change. Herbert Marsh (1757-1839), Lady Margaret professor of divinity at Cambridge, had studied under Michaelis at Leipzig, and did much to familiarize his countrymen with the results of an improved Biblical criticism. Niebuhr's *History of Rome* (1827-32), translated by Thirlwall and Julius Charles Hare, found, it was said, more readers in England than did the original in Germany; while the publication of *The Philological Museum*, commenced in 1831 under the editorship of the same two eminent scholars, initiated a corresponding advance in classical scholarship. In 1838-43 appeared *The Early History of Rome*, by Thomas Arnold (1795-1842), a work largely founded on Niebuhr's researches, which were further brought under the notice of English scholars by the writings of Arnold's intimate friend, Bunsen, who resided in England as Prussian ambassador to the English court during the years 1842 to 1854. On the other hand, Sir G. C. Lewis (1806-63), in his *Enquiry into the Credibility of the Early Roman History* (1855), challenged, with great acumen, some of Niebuhr's most important conclusions. Between 1835 and 1850 appeared the rival histories of Greece by Grote (1794-1871) and Thirlwall (1797-1875). Each author had commenced his researches unknown to the other, although they were personal friends.

**Comte.** The speculative tendencies of French philosophy found notable expression in the writings of Charles Comte (1782-1837), who, in his *Traité de Législation*, reopened the question of the influence of physical laws upon civilization, a subject which he illustrated by a new array of facts and with great felicity of treatment. The better-known Auguste Comte (1798-1857) compiled his *Cours de philosophie positive*, and founded a school which, in the course of another generation, was represented by an extensive literature. The movement extended to England, and Buckle (1821-62), in his *History of Civilization*, reviewed the chief theories of his predecessors, and propounded his own conclusions, with unprecedented

wealth of illustration and remarkable ability. His views were, however, challenged by a large section both of the religious and the scientific press, and probably no work of equal merit was ever subjected to a like amount of unfair and disparaging criticism.

**France: 19th Century.** The activity of the more strictly historical school in France now began to command the attention of all learned Europe, and J. S. Mill (writing in 1844) affirms that their writings far surpassed those of Germany in importance. The works of Sismondi (1773-1842), Thierry (1795-1856), Mignet (1796-1884), Thiers (1797-1877), and Michelet (1798-1874) exhibit characteristic merits, but all, with the exception of Mignet, betray the influence of strong partialities very imperfectly disguised. The writings of Guizot (1787-1874) and De Barante (1782-1866) present, however, a more distinctly scientific spirit. Guizot, who edited Gibbon, and first drew attention to the invaluable labors of Savigny, defined anew the true aims of the historian; it was his view that faithful research, with its results duly assimilated, ought to enable the writer to supply such a portraiture of the past that it should be, both to him and to his reader, a veritable present. De Barante, on the other hand, in his *Histoire des Ducs de Bourgogne*, sought to carry out the theory which he unfolds in his preface—a theory closely resembling that of Lucian—whereby he postulated two primary canons: the necessity for the utmost vigilance in the acceptance of facts, and the most rigorous self-effacement on the part of the historian in their exposition. He preferred, accordingly, wherever it was possible, to leave his early chroniclers to tell the story in their own language. But their quaint and obsolete diction repelled the ordinary reader, and it was reserved for Thierry and Michelet, two young and enthusiastic scholars, combining a special faculty of graphic description with the results of conscientious study, to advance the art of historical narration a further stage. To Michelet the world is also indebted for a translation of the works of Vico (1835), together with a criticism of his genius, which revived and for the first time did justice to the memory of that great philosopher.

**Late 19th Century.** During the last quarter of the 19th century the path marked out by Ranke seemed to attract the best historic talent, the facilities for its pursuit having also largely multiplied. Free access was afforded to the national archives of all the chief countries of Europe, their contents were carefully calendared, the more important manuscripts in both public and private libraries were printed and published; while innumerable ancient inscriptions, a source which Ranke himself regarded with despair, were brought to light and deciphered. Labors of scholars such as Pertz, Waitz, Mommsen, Curtius, Sickel, and Ficker in Germany, Stubbs, Freeman, and S. R. Gardiner in England, G. Monod, Albert Vandal, and Lavissee bore fruit in many works. The two outstanding historians in Europe during the second half of the 19th century were H. Taine in France and J. Burckhardt in Switzerland. Taine stressed the influence environment plays in history. Burckhardt insisted that history is an art of evaluation. The impact the works of both men had on historical criticism can hardly be overestimated. Both of them had opened new vistas into the past and the future, Taine with his monumental work on *Les origines de la France contemporaine* and Burckhardt on *The Civilization of the Renaissance in Italy* and on *Force and Freedom, Reflections on History*.

**Early Twentieth Century.** In the 20th century the German historian Karl Lamprecht introduced social psychology into history writing, and OSWALD SPENGLER in his *Decline of the West*, resuming the old theory of cycles in history, gave it a new meaning by applying Goethean and Nietzschean concepts to it. Also, in the 20th century G. Ferrero taught the world a new outlook on Roman history and on the era of Napoleon; and M. Rostovtzeff gave the world

another no less profound explanation of ancient Roman history.

A new great era of history writing was ushered in with the beginning of the 20th century. Men like Coulton, Charles Oman, Tout, Toynbee, Trevelyan, Cecil Roth, Seton-Watson did outstanding work in their different fields. Concurrently with this improved standard of performance, the conviction steadily gained ground that, if history was to be regarded as a serious study, it had to assume a yet more scientific form and character. No preconceived theory, no national sympathies, no political ties were to be permitted to give it bias. The primary and paramount consideration was to ascertain accurately each fact, as far as the known evidence permitted; the ultimate aim was the scientific synthesis of the whole body of such facts.

**Broader Interpretation.** As the 20th century advanced, and historians watched and experienced two world-devastating wars, there gradually developed a feeling that a passion for facts alone, and an emphasis on specialization were not sufficient to produce history that was really significant as a study of human life. It came to be realized that economic history, political history, and other phases of historical study were being emphasized to the detriment of a unified portrayal of cultures, peoples, and civilizations. Excessive national feelings, and purely local interests were confining history to tiny, detailed studies of areas artificially delimited in time and associations.

In reaction to this narrowness of late 19th century and early 20th century historical study, there developed a tendency to study broader areas and issues. Historians like Spengler, ARNOLD TOYNBEE, and others were not afraid to venture on studies of the rise and fall of civilizations, and even in histories of lesser scope, it was not considered reprehensible to attempt to synthesize elements heretofore considered in detail, and to attempt to delineate a definite thread of development where historical evolution could be traced in some definite degree. Supplementing this trend there was also a great emphasis on the intangible factors in history: psychological, religious, and traditional feelings, which have greatly influenced the course of human development. Application of these new techniques on the sure foundation of historical research methods developed in the 19th century will undoubtedly result in more significant as well as more accurate studies of human life and institutions.

**The Earliest Historical Writing in America** consisted of semi-biographical accounts of discoveries, explorations, and settlements, such as John Smith's (1580-1631) *True Relation of Virginia* (1608), William Bradford's (1588-1657) *History of Plymouth Plantation* (1630-1650, published 1856), and John Winthrop's (1588-1649) *History of New England* (1630-1649), published 1790, 1825-1826. During the latter half of the 18th century the literary tone was decidedly polemical. Whig and Tory pamphleteers regarded history as a storehouse from which arguments might be drawn to sustain their political theories. The only work of permanent value was a *History of Massachusetts Bay* (1764, 1828) by THOMAS HUTCHINSON (1711-1780).

**Irving, Prescott, and Motley.** If history be considered primarily as a branch of literature, if Macaulay and Michelet rather than Ranke and Stubbs are typical historians, the period from the Revolution to the close of the Civil War, 1783-1865, was the classical age in the United States. WASHINGTON IRVING (1783-1859), W. H. PRESCOTT (1796-1859), and J. L. MOTLEY (1814-1877) sought in Spain, Holland, and Spanish America the picturesque traditions which their own country did not afford. They were not profoundly philosophical, they were not gifted with keenness of critical insight, but there is a vigor and a seductive charm about their work which still commands our interest and our admiration. In vivid and romantic delineation Prescott's *Conquest of Mexico* (1843), *Conquest of Peru* (1847), and *History of the Reign of Philip*



the *Second* (1855–1858) easily take first rank, but neither he nor Motley could make use of that good humored whimsical satire which has given Irving's *History of New York by Diedrick Knickerbocker* (1809), so wide a reputation. Motley's blind devotion to William the Silent, his ill-concealed hatred of Spain, and his defense of the Arminian party in Holland are characteristic of the time. History was expected to be partisan.

**Bancroft and His Contemporaries.** Another group of students during this period included GEORGE BANCROFT (1800–1891), Jared Sparks (1789–1866), J. G. Palfrey (1796–1881), and Richard Hildreth (1807–1865), all New Englanders, graduates of Harvard College, and adherents of the Unitarian revival. They addressed themselves entirely to American affairs, considering them from the political point of view. Bancroft's stupendous *History of the United States* (10 vols., 1834–1874, 6 vols. ed. revised, 1883–1885) was the first considerable work in America written according to the modern canons of historical investigation, but its bias against Great Britain was so strong that subsequent writers have never been able entirely to emancipate themselves from its influence. Spark's *Life of Washington* (1834) was of the Carlyle hero-worship type, and his edition of the *Writings of Washington* (1834–1837) was the subject of considerable adverse criticism. Palfrey represents the New England filiopietistic school, which defends the entire Puritan program of that section, ecclesiastical as well as political. Hildreth's *History of the United States [to 1821]* (6 vols. 1849–52) is a comprehensive, well-written work, with considerable emphasis on economic history. It is somewhat Federalist in tone.

**Seminar Method and the Professional Historians.** It was Herbert Baxter Adams who in 1876 first introduced the rigorous principles of scientific research from the German universities to Johns Hopkins. The seminar system was soon extended to Harvard, Columbia, Wisconsin, and other universities. Henry

Adams and Justin Winsor who edited the *Narrative and Critical History of America*, taught at Harvard where the graduate seminars influenced many young men to produce monographs based on material found in historical archives. The universities rather than distinguished writers became the principal source of historical writing. While this did not produce works on a par with the literary excellence of Parkman or Prescott (except for the individual work of Henry C. Lea and Henry Osgood Taylor) the net result was a large group of professionally trained historians who broke away completely from the filiopietistic school of American history to write history on the more accurate foundations of scholarship. The seminars under the direction of J. Franklin Jameson, William A. Dunning, Herbert L. Osgood, FREDERICK JACKSON TURNER, Edward Channing, Albert Bushnell Hart, and Carl Becker, to name only a few of the outstanding historians in the first half of the 20th century, carried on historical scholarship of a high critical order. The most novel ideas on American historiography were advanced by Frederick Jackson Turner who in an essay on the influence of the frontier in our history, written in 1893, brought out the importance of cheap land in molding the institutions of the settlers and creating a unique type of social democracy. (See FRONTIER.) There were numerous other social historians.

The layers of obscurantism that had been carefully stacked over the War of Independence and the events surrounding the writing of the Constitution were examined critically by C. H. Van Tyne who gave the Loyalists their proper award; Carl Becker and Arthur M. Schlesinger who analyzed the ideas and economic forces that played around the heads of the leaders in the Revolution; Max Farrand and CHARLES A. BEARD whose annotation of Convention records and economic interpretation of the Constitution, respectively, discerned more than patriotic interest in a strong central government. The documents of the Colonial period were investigated and massive scholarship displayed in Herbert L. Osgood's *History of the English Colonies in America*. His details guided Charles M. Andrews and JAMES TRUSLOW ADAMS in their later studies of Puritanism. Regional history was pursued by Herbert E. Bolton and H. I. Priestley on the Southwest; Clarence W. Alvord for the Mississippi Valley; William E. Dodd and Ulrich B. Phillips for the antebellum South. In intellectual history a galaxy of first-rate interpreters studied the field: James Breasted on Egypt; Charles H. Haskins, Henry C. Lea, H. O. Taylor, Lynn Thorndyke, and G. L. Burr for the medieval period; JAMES HARVEY ROBINSON, James T. Shotwell on the development of modern thought in general and V. L. Parrington on the trend of ideas in the United States.

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**HISTORY OF SCIENCE SOCIETY.** See AMERICAN COUNCIL OF LEARNED SOCIETIES.

**HITACHI**, city, Japan, on the E coast of Honshu, Ibaraki Prefecture, 83 miles by rail NNE of Tokyo. It is an important industrial center. During World War II it was 72 per cent destroyed by American naval shelling and superfortress raids. Pop. (1950) 56,066.

**HITCHCOCK, ALFRED JOSEPH**, 1900–, English motion picture director, was born in England and educated at St. Ignatius College, London. He early began to work with the Famous Players Company and with Gainsborough Pictures; among his more notable English productions were the two film classics, *Thirty-Nine Steps* and *The Lady Vanishes*. In 1938 he came to Hollywood, where he directed *Rebecca* (1940), which received the Academy Award in 1941, and *Foreign Correspondent* (1940). A master of suspense, his effects are often atmospheric and are usually achieved in a seemingly casual manner. Common among the devices used by him are the unprepared shock and the accentuation of the terrifying through contrast with the ordinary. Though often suggesting the horrible, almost never does he attempt to actually depict it on the screen. His later films include *Suspicion* (1941), *Shadow of a Doubt* (1943), *Lifeboat* (1944), *Spellbound* (1946), *Under Capricorn* (1949).

**HITCHCOCK, EDWARD**, 1793–1864, American geologist, was born in Deerfield, Mass., and ordained a Congregational clergyman in 1821. He was professor of chemistry and natural history at Amherst (1825–45), president of the college (1845–55), and professor of natural theology and geology (1855–64). In 1830–44 he was state geologist of Massachusetts and conducted the first survey of a state authorized by the government. His chief works are *Economic Geology* (1832); *Report on the Geology, Mineralogy, Botany and Zoology of Massachusetts* (1833); *Geology of Massachusetts* (1841); *Religion of Geology and Its Connected Sciences* (1851), etc.

**HITCHCOCK, FRANK HARRIS**, 1869–1935, American lawyer and public official, was born in Amherst, Ohio. He was a biologist in the U.S. Department of Agriculture, and later first assistant postmaster general (1905–8), and postmaster general under President Taft (1909–13). He established postal savings banks, the parcel post, and the first air mail service.

**HITCHCOCK, THOMAS**, known as Tommy, 1900–1944, American polo player, was born in Aiken, S.C. Considered the greatest polo player of all time, he was one of the few ten-goal players in the world, and starred in seven international matches (1921–39). An aviator in the Lafayette Escadrille during World War I, he was shot down in enemy territory and escaped through Switzerland. In World War II, he commanded an American fighter group and met death in a plane crash in England.

**HITLER, ADOLF**, 1889–1945, leader of the German National Socialist movement and Reichschancellor. While most of Adolf Hitler's ancestors were small peasants living in Upper Austria, Alois Hitler, Adolf's father, had started a new chapter in the family history by becoming a small government

official. At the time of Adolf's birth he was stationed as customs inspector in Braunau-am-Inn, a border town in a rather remote section of the Austro-Hungarian monarchy adjacent to Bavaria in Germany. He was later transferred to the larger cities of Passau and finally to Linz, the capital of Upper Austria, where he retired in 1895. At this time Adolf Hitler enrolled in the public elementary school of Fischlham near Linz. In 1903 his father died and Adolf continued



PAUL'S PHOTOS  
Adolf Hitler

his studies at the Realschule in the near-by city of Steyr. His grades were rather poor and he barely finished the equivalent of junior high school in 1905.

**Early Frustrations.** The young man backed away from a continuation of his formal studies and decided to become an artist. After two years of hesitation he went to Vienna, the capital of the monarchy, and tried to enter the Academy of Fine Arts.

He took the entrance examination in 1907 and was rejected. He tried again in 1908 but his drawings did not meet the minimum requirements and he was not even admitted to another test. During these years he was supported by his mother who lived on her pension as widow of a petty government official. But his mother died in 1908 and Hitler, 19 years old, had to face the world without any further family support and without the benefit of any educational degree.

Talentless, but extremely ambitious, he continued to believe in his artistic career and tried to support himself by selling his paintings, but his earnings were hardly sufficient to pay for his food and lodgings in a cheap rooming house. He was occasionally forced to take manual jobs as a building-trade apprentice, but he shared the German lower middle class contempt for manual labor and preferred to paint cheap postcards which a friend peddled about town. In 1913 he finally moved to Munich, the artistic center of Germany, where he made a scant living as designer of commercial posters.

The frustrating life in Vienna provided the later leader of a frustrated nation with the heterogeneous ideas to be compiled into the doctrine of National Socialism. A sense of personal frustration became deeply impressed upon Adolf Hitler's character. His personal resentment found an outlet in hazy ideas of rebellion against the unfriendly world of bourgeois capitalism and this resentment became coupled with an intense hatred of Jews and Slavs, groups which he had met in the multi-national metropolis of the Hapsburg empire. He became exceedingly shy and withdrawn and for the rest of his life he lacked the warm touch of close personal friendships. He developed ascetic tastes, became a vegetarian, and later on, avoided alcohol and tobacco.

**World War I** interrupted the drab existence of the unhappy Bohemian in Munich. Refused in the Austrian army because of a physical defect, he volunteered in the German army and was accepted. He served on the Western front with the infantry as a corporal and dispatch carrier. For personal bravery he was awarded the coveted Iron Cross, 1st class. Hitler was for the first time in his life happy. He was still unable to make friends among his comrades and his aloofness was probably the reason for not being promoted. But at last he had found a job to his liking. Unlike his more naturally inclined comrades his enthusiasm for the German cause did not falter during the long years of trench warfare. The memory of his miserable civilian life and the hate for a bourgeois-like existence were strong enough to keep him going as soldier for Germany.

The collapse of 1918 found him in a hospital in



Pasewalk where he had been taken as a victim of a gas attack. He drifted back to Munich but preferred to make his living as a political agent for the new German army of the Weimar Republic, commanded by officers trying to stem the tide of leftism. It was a time of political unrest, of inflation, and of the breakdown of all established values within Germany. New political parties arose and Hitler joined a small group to become party member No. 7 of the German Workers' party, which name Hitler later changed to National Socialist German Workers' party (N.S.D.A.P.). It was in this period that he suddenly discovered a gift which probably more than anything else explains his rise to power. He was a born political orator, extremely able to appeal to the emotionalism of his audience.

**Rise of Political Power.** The beginnings of his political career were rather slow and obscure. He captured leadership of his small party and slowly acquired some reputation as a political orator among a small group of radicals operating on the fringe of the established right wing parties. The war had left Germany with disgruntled officers and soldiers who refused to disarm. Hitler's fanaticism and abilities as an agitator brought him the support of officers with reactionary leanings. The famous air ace Hermann Goering and Captain Ernst Roehm joined the movement as the party's private army (SA) was being organized. From then Hitler's life became a part of the National Socialist (Nazi) movement. The desultory Bürgerbräu putsch of 1923 resulted in Hitler's imprisonment in Landsberg. In prison he wrote *Mein Kampf* (My Struggle), a crude but forceful autobiography which became the bible of the Nazi movement. His fellow prisoner and later close associate Rudolf Hess helped him write the book.

The economic depression of 1929-32 helped National Socialism and its main apostle Hitler to new political gains. He traveled all over Germany and preached his gospel of hatred and despair drawing larger and larger crowds who listened hypnotized to his shrill voice. However, in spite of all efforts his party was unable to gain an absolute majority in the elections to the Reichstag, although by 1932 it had become its largest party. By making good use of the general confusion among the other groups and parties Hitler finally forced himself upon the aging Reichspresident Hindenburg, who entrusted the Reichschancellorship to him on Jan. 30, 1933. Once in power Hitler and his party lost little time in transforming the Weimar democracy into a totalitarian state.

The bloody purge of June 30, 1934, dispelled the last doubt that Hitler had placed himself beyond all restrictions of law and personal morality. Together with Ernst Roehm hundreds of Hitler's friends and early followers were murdered in a successful attempt to impress his personal authority on everybody. In the same year Hindenburg died and Hitler united in his persons the offices of president and chancellor of the German Reich. But despite his tremendous personal success he remained unstable in his reactions. He seemed unable to come to a resting point in his personal life or in the German policy which became increasingly more a mirror of his own personality.

**World War II.** Hitler's foreign policy led to World War II and he assumed personal command of the German army. After initial successes defeat followed and the final debacle found him in an underground bunker of the Reichschancellery in Berlin. While the Russian army stormed the capital, Hitler, who was largely responsible for the disaster, committed suicide after having wed Eva Braun, his mistress for several years. No exact records remain but all evidence indicates that he and his wife died on Apr. 30, 1945. His and his wife's remains were cremated by the SS guard, while Russian shells were exploding in the surrounding buildings of the capital. See GERMANY, History; NATIONAL SOCIALISM.

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**HITTITES**, the name given to the first great ancient kingdom of Anatolia (Asia Minor). At the time of its widest extent (c. 1300 B.C.) it spread well down into Syria, and beyond the Euphrates at Carchemish. The Hittites mentioned in the Bible were, in the main, remnants of former colonies in Syria which persisted after the breakdown of the parent Anatolian state. The relationship of the Hittites with the earlier village stages in Anatolia is not yet clear. The available human skulls from early Anatolia are of one or another variant type of the Mediterranean race. The classic short-headed Hittite of the Egyptian reliefs (described below) was apparently neither an early type nor a common one at any time. The Hittite language is described as proto Indo-European.

References to the Hittites are frequent in the Old Testament. According to Gen. 10:15, Heth, the supposed founder of the race, was a son of Canaan. In the account of the purchase of the field of Machpelah by Abraham, the Hittites are described as living at Hebron (Gen. 23), and Ezekiel includes them among the founders of Jerusalem (Ezek. 16:3). Elsewhere in the Old Testament, the Hittites appear as a northern people; the betrayer of Bethel to the descendants of Joseph fled into the land of the Hittites (Judg. 1:6); Solomon imported horses from the kings of the Hittites and of Aram (1 Kings 10:29); and it was of the "kings of the Hittites" that the panic-stricken besiegers of Samaria were afraid (II Kings 7:6).

**The Old Hittite Kingdom.** The political history of Anatolia and the Hittites begins about 2000 B.C. By this time several generations of Assyrian merchants had been living in Asia Minor. Some of their correspondence in cuneiform (the "Cappadocian letters") has been recovered. The Assyrian merchants report that numerous principalities were then held by princelings, each trying to expand his territory at the expense of his neighbor. The names of some of these princes are known, but it is not certain if they were "Hittite" in the later sense. The Old Hittite Kingdom began soon afterward with the dynasty of King Labarnas at Hattusas. This was to be the capital for some time. The Old Hittite Kingdom was a time of consolidation at home, accompanied by considerable political intrigue. By about 1750 B.C. King Mursilis was not only strong enough to expand southward into Syria but was also able to raid and plunder Babylon. More political trouble followed at home, however, and the Old Kingdom came to an end sometime after 1650 B.C.

**The Hittite Revival** came almost 200 years later with the beginning of the empire. Egyptian and Mesopotamian records of this time begin to indicate the role of the Hittites in the "first great internationalism" (see EGYPT; MESOPOTAMIA). Thothmes III (1470 B.C.) received tribute from "the Greater Land of the Hittites"; and at the time the Tell-el-Amarna letters were written (at the close of the XVIII Egyptian Dynasty), the Hittites menaced the north Syrian provinces of Egypt's realms, and intrigued with the vassal princes and governors of Canaan. The Hittites reached the height of their power by 1375 B.C. under Shubbiluliuma, whose capital at Hattusas (modern Boghazkeui) has been excavated by German archaeologists. As the Egyptian power decayed, the Hittites made themselves masters of Syria, and established a southern outpost at Kadesh, on the Orontes. Carchemish (now Jerablus), which commanded the ford across the Euphrates on the highroad which led from Babylonia to the Mediter-

anean, was already in their hands, and Hittite chieftains were making raids in the south of Syria and seizing Egyptian colonial territory.

The 19th Egyptian Dynasty endeavored to restore the Egyptian empire in Asia. But the way was blocked by the Hittites; and after 21 years of warfare, Ramses II (1300 B.C.) was obliged to make a treaty of peace with "the great king of the Hittites," at Kadesh on the Orontes. By this treaty it was stipulated that, while Hittite possession of Syria was formally acknowledged, Canaan should remain Egyptian. In their war with Egypt the Hittites had summoned to their aid vassals and allies from the more distant parts of Asia Minor—Lycians, Nysians, and Dardanians. Hittite authority must therefore have been more or less obeyed throughout Asia Minor and Syria.

**Decline of the Hittite Power.** The Hittite Empire soon fell prey, however, to the same disruptive forces which seem to have weakened all the great Near Eastern states around 1200 B.C. The strongest of these forces was the incursion into Anatolia of the "Peoples of the Sea" (see EGYPT). The fall of Troy was one incident in this story. The Arameans of the inland Syrian provinces broke away as Hittite control weakened, but certain regions remained loyal. These later became "Syro-Hittite" states like those of Carchemish or Milid (the modern Malatiyeh). The Hittites of the plain of Amuq on the banks of the Orontes, were among the last relics of the once-powerful Hittite province in Syria.

The capture of Carchemish by the Assyrian king SARGON II in 717 B.C. finally put an end to the Hittite domination in Syria, which had lasted for more than 700 years; from henceforward the descendants of Hittites survived mainly in the Taurus. The Khate, or Hittites of the cuneiform inscriptions of Armenia, lived eastward of Malatiyeh.

The accuracy of the portraits of the Hittite nobility which we owe to Egyptian artists is confirmed by their own sculptures. They were thickset, with protrusive nose and jaws, high cheekbones, and large nostrils. The face was beardless, the skin yellow, and the eyes and hair were dark. The characteristic dress was a tunic over which a cloak was thrown, open on one side to facilitate walking; the head was protected by a cap or tiara, and the legs by high boots with upturned toes. For arms the Hittites had a spear and a short sword which was carried in the belt.

Their art may have been related to that of Babylonia. Among other things it is distinguished by a certain heaviness, if not clumsiness, of form, and by a love of composite animal figures. At Boghazkeui and Eyuk, for instance, we find a two-headed eagle, which, adopted in the later ages by the Seljuk sultans, passed, through the crusaders, into Europe; while the winged horse, the prototype of the Greek Pegasus, was also a Hittite symbol. Hittite art, in fact, was the starting point of that art of Asia Minor which exercised so great an influence upon the art of early Greece.

Along with the art went a peculiar system of hieroglyphic writing. The characters are usually in relief, and the lines run in *boustrophedon* fashion. Thanks to the work of Gelb, Hrozný, and Meriggi, the hieroglyphs have now been essentially deciphered. The Hittites carried on their international correspondence in Akkadian cuneiform, which was the *lingua franca* of the day.

Little is now known of the details of Hittite religion. It may yet be found that their pantheon had Indo-European aspects. Particular worship was paid to Teshup, the Weather god, and to the Sun god.

LINDA BRAIDWOOD

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**HIVES** is the popular name for the skin condition which doctors call *urticaria*. Hives always itch severely and are characterized by the appearance of whitish

areas, sometimes small, sometimes very large, sometimes round, sometimes irregular in shape. Adjacent hives may run together and coalesce, forming very large patches of raised, whitish skin with irregular edges. Hives may appear quickly and may disappear quickly, migrating from one part of the body to another. Urticaria is one of the manifestations of ALLERGY. Urticaria commonly follows the eating of foods to which the patient is allergic. The well-known strawberry rash, one of the most common forms of skin allergy due to foods taken internally, is a form of hives. So also are the shellfish rashes from which many people suffer. Hives may also arise as a result of external contact with a substance to which the individual is allergic, as in the case of textiles, furs, dyes, cosmetics, industrial materials, or any substance which the individual may contact in the course of his daily work and his daily life.

**Treatment.** The ultimate cure for hives is to find the allergy and remove the cause. This is often a lengthy job. In the meantime the patient desires at least temporary relief from the itching. This is best accomplished first by avoiding overheating of the body. The individual should be clothed lightly while he goes about, and when he goes to bed should be thinly covered, although he should not, of course, be chilled. The local treatment of hives is best carried out with tepid baths. A tepid bath is a bath between 95° and 100°, that is, somewhere near the temperature of the body itself. Into this bath can be put any of a number of substances which tend to give relief. One of the best of these is oatmeal. Place a cup of oatmeal in any cloth bag, such as a salt or sugar bag, tie it up, then put it into the bath and squeeze water through the bag. The result will be a milky solution in which the patient can be immersed and which will give considerable relief of the itching. A cupful or more of baking soda in a tepid bath will frequently give a great deal of relief. If the patient is an adult, scratching should be avoided by the exercise of will power. If the patient is a child, scratching should be prevented by tying the hands into mitts or if necessary by putting splints on the arms so that the elbows cannot be bent and the child cannot reach the area where the hives are. If hives are scratched they may be infected or the temporary condition may be converted into a dermatitis which will be very much more distressing than the hives.

In rare instances hives may indicate some deep-seated and more serious disease, such as an obstruction to the bowel, possibly from the growth of a malignant tumor. While hives are ordinarily a manifestation of allergy, the thorough physician will make a complete examination of the individual and will consider every possible cause and source of hives before he is satisfied that they are a manifestation of allergy to food, or to substances with which the patient comes into contact.

W. W. BAUER, M.D.

**HIWASSEE DAM.** See DAM.

**HJÄLMAREN**, a lake in S central Sweden, E of Stockholm. Its shores indent both Örebro and Södermanland counties. The lake drains northeast, past the city of Eskilstuna, into Lake Mälaren and is connected by canal with the city of Arboga.

**HJÖRRING**, county, Denmark, the northernmost county of Jutland, bounded on the E by the Kattegat, on the S by Aalborg County and Lim Fjord, on the SW by Thisted, and on the W and N by the Skagerrak. The county includes the small island of Læsø in the Kattegat. It is largely an agricultural region, and fishing is carried on off the coasts. Other industries include textile and engineering works, and small manufactures. The chief city is Hjørring, which dates from the 13th century.

**HOACTZIN**, or *Hoactzin*, a bird of N and W South America noted for its unique structural characteristics among the adults and the nestlings. The adult is a small pheasant-like bird with a long erectile crest of feathers, and bristly lashes around



the eyes. The upperparts are dark brown, glossed with olive and slightly varied with white; the underparts are pale buff shading into chestnut on the sides and abdomen. Remarkable structural features in the adult are the large, muscular crop which resembles a gizzard, the breastbone with a keel only posteriorly, and the large concavity in the breast muscles to accommodate the crop.

Hoatzins, *Opisthocomus hoazin*, live among low trees and bushes along shores of streams and lakes, and occur usually in flocks of 10 to 20 individuals. They consume great quantities of leaves, certain kinds of which impart a strong disagreeable odor to the bird's flesh. The nest is built of sticks loosely laid together, and is located in bushes near the water. The eggs are two or three in number, oval, yellowish white and blotched with reddish-brown. The nestlings are hatched naked and are the only living birds that have the thumb and index finger of each wing provided with claws, by means of which the young can climb among the branches soon after hatching. The relationship of the hoatzin to other birds is not well understood; at present it is placed among the gallinaceous birds, order Galliformes.

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**HOADLY, BENJAMIN**, 1676–1761, English religious controversialist and prelate, was born in Westerham, Kent. He took part in the various controversies of his day, condemning "nonconformity" and "occasional conformity." In politics he led the Low Church party, which supported the revolution, and on the accession of the Hanoverians was appointed bishop, successively, of Bangor (1715), Hereford (1721), Salisbury (1723), and Winchester (1734). While holding his first bishopric, he carried on what is known as "the Bangorian controversy" with the High Churchmen (e.g., Atterbury) as to the extent of ecclesiastical authority. In theology he was a latitudinarian, with an inclination toward Socinianism (see SOCINUS).

**HOANG HO**. See HWANG HO.

**HOAR, EBENEZER ROCKWOOD**, 1816–95, American cabinet member, brother of GEORGE FRISBIE HOAR, was born in Concord, Mass., studied law at Harvard, and later became an antislavery Whig leader. He was a judge in the Court of Common Pleas (1849–55), an associate judge in the Massachusetts Supreme Court (1859–69) and attorney general under Ulysses S. Grant (1869–70). His appointment to the Supreme Court was not approved (1870) because many senators were angered by his stand that nine new circuit judgeships should not be used for patronage. He resigned his cabinet post (1870) and in 1871 was on the joint high commission which settled the *Alabama* claims by the Treaty of Washington. Serving in Congress (1873–75), he was active in the revision of U.S. statutes.

**HOAR, GEORGE FRISBIE**, 1826–1904, American legislator, son of Samuel Hoar (1778–1856), was born in Concord, Mass. He was educated at Harvard (1846) and at the Dane Law School there, and began to practice in Worcester, Mass. He was a member of the state House of Representatives in 1852, and of the state Senate in 1857, and served as Republican representative from Massachusetts in the 41st, 42nd, 43rd, and 44th Congresses, declining a renomination. He was elected to the U.S. Senate, as a Republican, to succeed George S. Boutwell, took his seat in 1877 and was re-elected in 1883, 1889, 1895, and 1901. Throughout his career Senator Hoar was a conspicuous figure in Republican political circles; he presided over the Massachusetts State Republican conventions in 1871, 1877, 1882, and 1885; was delegate to the Republican National conventions in 1876, 1880 (when he presided), 1884, and 1888, and chairman of the Massachusetts delegations of 1880, 1884, and 1888.

**HOAR FROST**, or **RIME**, the frozen dew particles or molecules of water from the air, which, when the temperature falls below freezing, are deposited upon grass, twigs, herbage, and other objects. It is also formed by the congelation of moisture arising from the ground, collecting upon bits of wood and other objects which have lain under the snow. Still another type is that which is seen in scattered clumps on frozen ponds and lakes. As its formation is most marked in a calm atmosphere, hoar frost occurs abundantly at the bottom of valleys and land-locked places; and, if these are sheltered from the sun's rays, may remain unmelted after the ice has disappeared from the surrounding plains. See DEW; FROST.

**HOARSENESS** is frequently encountered as a temporary complaint resulting from misuse of the voice, overindulgence in tobacco or alcohol, exposure to irritant fumes, or an infection of the upper respiratory tract. (See LARYNGITIS.) Because of inflammation in or around the vocal cords the voice becomes raspy and lower in pitch and may be lost completely for a time. Putting the patient to rest in a room kept warm and moist with a steam kettle will often relieve simple hoarseness. If the hoarseness persists without apparent cause a doctor should be consulted, for this may be a symptom of a serious condition that can be corrected if diagnosed promptly. Serious diseases which may cause hoarseness are CANCER, SYPHILIS, GOITER, and TUBERCULOSIS.

**HOATZIN**. See HOATZIN.

**HOBAN, JAMES**, c. 1762–1831, American architect, was born in Ireland and came to the United States around 1785. He designed the state capitol at Columbia, S.C. (1786–91), which was destroyed in 1865, but is mainly notable for designing and constructing the WHITE HOUSE (1793–1801) and rebuilding it (1815–29) after its burning by the British.

**HOBBART, GARRET AUGUSTUS**, 1844–99, American lawyer and legislator, vice-president of the United States in President McKinley's first administration, was born in Long Branch, N.J. He was graduated from Rutgers College (1863), was admitted to the New Jersey bar in 1869, practiced law in Paterson, N.J., was city counsel there (1871), and served in the state assembly (1873–78) and the state Senate (1879–85). He was a personal friend and influential adviser of President McKinley, and as vice-president was an official of much consequence in the administration. He died Nov. 21, 1899, before his term of office expired.

**HOBART**, city, Australia, capital of Tasmania, is picturesquely situated in the S part of the island, on the estuary of the river Derwent, at the foot of Mount Wellington. It has an exceptionally good climate and an excellent harbor. Hobart is a modern city, with broad streets, drives, parks, and a good tramway system. Its many handsome buildings include Government House, the Houses of Parliament, the town hall,

**Hobart**, on the south side of Tasmania, is shipping center of the fruit growing district of the island

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the museum and art gallery, the university, St. David's Cathedral, St. Mary's Cathedral, and the post office. The botanical gardens, covering 30 acres, are a popular resort. Industries include jam factories, flour mills, iron foundries, tanneries, and the manufacture of woolen goods. Exports include fruit, hops, grain, timber, minerals, and wool; imports are tea, sugar, tin, and coal. Hobart was founded in 1804, created a municipality in 1853, and a city in 1857. Pop. (1954) 95,223.

**HOBART**, city, NW Indiana, Lake County, on the Nickel Plate and the Pennsylvania railroads, about eight miles E of Gary in a region of grain and dairy farms. The town, platted in 1849 and incorporated in 1921, was named for the brother of George Earle, the founder. Much of Hobart's prosperity depends upon near-by clay pits which supply materials for several brick and tile plants. Pop. (1950) 10,244.

**HOBART**, city, SW Oklahoma, county seat of Kiowa County, on the Frisco and the Rock Island railroads, about 100 miles SW of Oklahoma City in a hilly farming and stock-raising region. The city was founded in the late 1890's and named for Garret A. Hobart, vice-president of the United States (1897-99). Creameries, packing and cold storage plants, cotton gins and compresses, and alfalfa and cottonseed oil mills are Hobart's chief industries. There are petroleum and natural gas wells in the vicinity. Pop. (1950) 5,380.

**HOBART COLLEGE**. See COLLEGES AND UNIVERSITIES.

**HOBBEMA, MEINDERT**, 1638-1709, Dutch landscape painter, was born in Amsterdam. A pupil and friend of Ruysdael, he traveled with him and often painted the same scenes. For instance, both artists did outstanding pictures entitled, "Ruins of the Castle of Breberode." At 30, however, Hobbema gave up painting as a profession when he married in 1668 the cook of the burgomaster of Amsterdam and secured through his wife's influence the position of town wine gauger. Continuing his art as an avocation, Hobbema executed numerous peaceful, idyllic pictures in which the transparent effect of sunlight is emphasized. He preferred landscape to figure painting and usually allowed other artists, among them Van de Velde and Van Loo, to paint in the animals and figures in his work. Despite his municipal position, both Hobbema and his wife were buried in pauper's graves and his paintings went unnoticed until the English artist, John Crome (1768-1821), became influenced by his treatment of sunlight. Hobbema's most famous pictures are "The Avenue at Middel-harnis" and "The Water Mill" in the Louvre. See DUTCH ART AND ARCHITECTURE.

**HOBBS, THOMAS**, 1588-1679, English philosopher, was born in Westport, England, where his father held the position of vicar. After a row on the steps of the church, Hobbes's father deserted his family, and an uncle took charge of the young family, sending Hobbes first to Robert Latimer's private school, and later to Magdalen Hall at Oxford. After his graduation, Hobbes became tutor to the future earl of Devonshire. His first trip to the Continent in 1610 was with his pupil. The intellectual activity of Paris stimulated Hobbes, and he formed friendships which were to stand him in good stead during his later exile.

**Works.** In 1629 he published his translation of Thucydides. On another trip to Europe in 1636 he met Galileo and Descartes. His work, *The Elements of Law, Natural and Political*, was circulated privately in 1639. It supported the king, brought the disapproval of Cromwell, and in 1640 Hobbes fled to Paris and remained in exile for 11 years. During this time he engaged in controversies with Descartes and other philosophical figures. His master work, *The Leviathan*, appeared in 1651 (see LEVIATHAN, THE). When Charles II returned to power, Hobbes re-

turned to London where he became a favorite of the king. In 1666, ecclesiastical authorities banned his *Leviathan* and accused Hobbes of atheism. He also wrote *De Cive* (1642), *De Corpore Politico* (1650), and, *Behemoth*, published posthumously. Though he was refused permission to publish ethical works, he lived and wrote undisturbed in London for the remainder of his long life. At his death, he was respected as one of England's great men.

**Philosophy.** Hobbes's philosophy was based upon subjective experience; the senses, according to him, are mankind's only mode of knowledge. Though he wished to be thought of as a mathematician and scientist, his fame rests upon his contributions to political thought. He believed that man was originally endowed with freedom, but claimed that primitive man had given his freedom to a ruler in return for protection, and that therefore the king had the right of absolute rule. This viewpoint irritated both republicans and advocates of the "divine right of kings." Hobbes feared anarchy above all other things; a stable society, built upon a sound structure with power in the hands of one man, was the goal of his thought and analysis. His attitude toward religion was that religious forms are useful and desirable implements to a stable society, but that apart from its value as a social institution, it has little validity. One of the pioneers in psychology, Hobbes was also a founder of sociology.

HELEN STEWART

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**HOBBING**. See GEAR CUTTING.

**HOBBLEBUSH**, the common name given to a species of *Viburnum* (*V. alnifolium*) found in North America from New Brunswick and Michigan to North Carolina. It is a low shrub with wide spreading, often procumbent branches. It has cymes of small five-petaled white flowers, and the fruit is an oblong purple berry. It is also known as the American Wayfaring Tree.

**HOBBS**, city, New Mexico, Lea County, on the Texas and New Mexico Railroad, 100 miles SE of Roswell. It was founded by James Hobbs, a Texan, in 1907. After the discovery of oil in 1927 the city became a center for the manufacture of gas and oil-well supplies. There are oil refineries. Irrigation of the surrounding land has stimulated the growing of vegetables, and Hobbs is also a market for livestock from the sheep and cattle ranches near by. Pop. (1950) 13,875.

**HOBBY, OVETA**, née Culp, 1905—, American public official, was born in Killeen, Tex., and educated at the University of Texas. In 1942 she was sworn in as first director of the WAAC (Women's Auxiliary Army Corps, later known as WAC) with the rank of colonel. After World War II she returned to newspaper publishing, and in December, 1952, President Dwight D. Eisenhower appointed her Administrator of the Federal Security Agency. She became the second woman to hold cabinet rank when the agency was changed to the Department of Health, Education and Welfare. She was sworn into office in April, 1953.

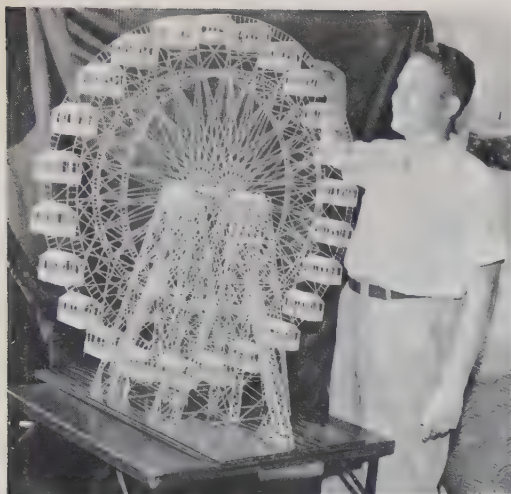
**HOBBY**, an absorbing interest that an individual follows in his own way in his spare time. Tastes vary as among epicureans, and what is savory to one is unpalatable to another. In a broad sense hobbies may be divided into three general categories, and some-



UNITED PRESS

Oveta Culp Hobby





ACME

**Toothpick Model of Columbian Exposition Ferris Wheel, built as a hobby, was a three-year project**



X-ACTO CRESCENT PRODUCTS CO.

**Wood Carving is one of several handicraft hobbies. Historical figures are specialty of this housewife**

times, by their very nature, the classifications may overlap one another.

**Avocational Hobbies.** These include such pursuits as golfing, fishing, hunting, baseball, chess, checkers, cards, sailing, canoeing, motoring, fencing, archery, billiards, bowling, horse racing, horseshoe, croquet, skiing, football, hockey, basketball and track. (These subjects are covered individually under their special headings throughout the encyclopedia.)

**Handicraft Hobbies.** The number of persons engaged in handicrafts, or the making of things, is innumerable, and they come from all walks of life. Men may follow such handicrafts as model building, woodcarving, cabinet making, and gem polishing and cutting. In many cases men have been occupied for years in building such things as an animated miniature village, circus, a coal mine or model railroad. Often these individual projects occupy an entire spare room in the home. Model railroads are sometimes set up in basement rooms, among the wash tubs and drying racks, and sometimes even encircle the furnace. Women pursue crocheting, sewing, knitting, quilting, and hooking rugs. Junior may be fashioning kites, while sister makes doll clothes for her little family. Handicraft hobbies often develop into money-making projects, particularly when the craftsman becomes skilled.

**Cultural or Aesthetic Hobbies.** These hobbies include music, the theater, dancing, painting, sculpturing, and collecting. The latter draws the greatest number of devotees in this group. Philately, the science of **STAMP COLLECTING**, numbers addicts by the thousands. In many cases, when the collection becomes extensive, the collector goes into business, selling his surplus and his duplicates. In point of numbers, stamp collecting leads the list of collectors. Active collectors, those constantly in the market for new stamp specimens, number approximately 150,000. This figure is based on the combined circulation of the various stamp publications. Much higher figures have been publicized, but they include what is known as stamp savers, who obtain their specimens from banks and commercial houses. Speculation or increased values are the lure of many who indulge in this activity, and, to some extent, this also applies to other branches of collecting.

The second largest group are the collectors of **ANTIQUES**, many of whom search for usable material which keeps or increases its value and can be handed on to the next generation.

Another important group is formed by the numismatists or coin collectors, numbering approximately

20,000. In this hobby classification, it is interesting to note that many bankers find surcease and relaxation in hunting out rare coins, and competition is keen when rare specimens are put up for sale. Some specimens have been known to bring hundreds, and in some cases thousands, of dollars above face value. An 1804 silver dollar, for example, of which only a few were minted, once brought \$5,000. See **NUMISMATICS**.

Button collecting has recently been revived. (See **BUTTON**.) At first, 100 years ago, buttons were collected more in the form of charm strings, but now it has become a specialized hobby, efficiently organized, with stabilized values for choice buttons. Specialized collectors do not interest themselves in numbers, and they do not collect common buttons any more than they collect common stamps or coins. Picture buttons are probably the most sought after for they are educational and cultural. Buttons with definite historical significance also bring a big premium, and collectors bid spiritedly to obtain them. Military buttons have many devotees among the men, and some of the collections represent the armies of the world.

The collecting of Indian relics is also one of the popular hobbies, because it is so closely allied with those fascinating studies of archaeology and ethnology. Artifacts have greatly increased in monetary value, because of the growing interest in the hobby. Museums springing up here and there are installing Indian rooms, thus creating some competition among private collectors for the relics of the Red Man, and the demand has created values for fine artifacts beyond the dream of collectors of a few decades back. The museum of the Heye Foundation, New York, is devoted almost exclusively to Indian relics, and one of the most important collections of this kind is housed in the museum of the Ohio State Archaeological Society, Columbus, Ohio. Other large Indian relic collections are in the National Museum, Washington, D.C., the Chicago Museum of Natural History, and Southwest Museum, Los Angeles, Calif.

Firearms-collecting is another specialized subject, having an estimated 10,000 followers. It is a subject that has a wide appeal among those with an inventive turn of mind, for the mechanics of old guns provide inspiration and mental stimulus. See **FIREARMS**; **PISTOL**; **SHOTGUN**.

Some collecting hobbies, such as first editions of items, sweep the country more or less as a fad, and then dwindle in interest. The same might be said of **AUTOGRAPH** collecting. However, buyers are still seeking holograph letters of historical importance,

for these are harder to fake or imitate. Other subjects that have steady and large followings are classic china and early American glass. Both of these topics are broad in their scope and many books and articles have been written on these subjects. Some of the later collecting hobbies, now increasing in interest and value, include early automobiles, crystal radio sets with ear phones, early phonographs, music boxes, and other such specimens that are yet in the memory of those now living. The demand for these has created good prices, and they will be the antiques of tomorrow.

**History.** The history of hobbies has never been fully traced. Perhaps no one has had the courage to attempt it since it has been so interwoven with life from its earliest times. The machine age has released masses who were previously hampered in their lack of leisure time. Nevertheless, it is known that centuries before, those beyond serfdom had time for the enjoyment of hobbies. Probably one of the greatest instigators of hobbies was Marco Polo, who carried handicraft specimens from one country to another, interchanging knowledge and culture. One of these was the intricate champlevé work of France which he took to China. The Chinese were quick to adapt their national patience to this intricate work and the outcome was beautiful cloisonné which no other country has been able to surpass.

Today the average man has some spare time on his hands, and has opportunities for the indulging of his hobbies. If he chooses travel as a hobby, he can even span the world in a few days, unhampered by the travel odds of a few hundred years ago. From birth to death, each individual, it seems, pursues some kind of a hobby, although in some it is an unconscious action. Shortly removed from babyhood, children unconsciously adopt hobbies. They try everything—they sing, dance, draw, paint, make and sail model boats, play marbles, pound, cut, hammer, and build. Pets also enter into the hobby picture—dogs, cats, rabbits, gold fish, ponies, and white mice, are a few of the common varieties of hobbies involving animals. There are the studies of birds' calls and identification by their plumage, identification of trees and leaves, the collecting of seashells and other things connected with the outdoors and nature. Some of these hobbies are followed avidly on through life, and quite frequently a whole new hobby pattern is set up in adulthood. A boy who builds model boats may, when he grows up, transfer his affection to baseball, where his interest is absorbed by comparing and recording the standings of the players. He has gone from the creative to an avocational hobby, but both are hobbies in that they are absorbing interests pursued in leisure time.

**Leisure Time.** Labor-saving machinery has reduced man's working week to a mere 37 or 40 hours, which allows for much free time. Federal and state governments have taken cognizance of this and have made appropriations in fields governed by leisure time and hobbies. In fact, the money allotted for helping disabled veterans through the promulgation of hobbies is evidence that government officials recognize the importance of hobbies in everyday life. There are many private organizations geared to the cause of leisure-time pursuits. Many activities for the young are sponsored by service clubs, social agencies, churches, and other public welfare organizations. Museums and schools are installing hobby courses, which may cover anything from the collecting of data on the beetle to that of the finest painting. Schools are teaching music appreciation, modeling, painting, knitting, sewing, wood carving, interior decoration, among other things. These numerous interests have brought about many new industries, the entire extent of which is not known. Hobby shows are being held in every city and town, and the citizen of today is keenly aware of the part that hobbies are playing. The wide field covered by hobbies may be gauged in a measure by the great number of magazines devoted

to special spare-time pursuits and by the thousands of books that are written each year covering hundreds of hobby interests.

O. C. LIGHTNER

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**HOBBOY**, a small European falcon sometimes used in falconry.

**HOBHOUSE, LEONARD TRELAWNEY**, 1864–1929, English sociologist and philosopher, was educated at Oxford. He served on the editorial staff of the *Manchester Guardian* (1887–1902) and was secretary of the Free-Trade Union (1903–5). An influential Liberal with collectivist sympathies, he wrote several political works, notably *The Labor Movement* (1893) and *Democracy and Reaction* (1904). In 1907 he was appointed professor in the University of London and the following year became editor of *The Sociological Review*. He undertook investigations in the fields of sociology, ethics, and the theory of knowledge, and made pioneering studies in comparative psychology. His research into the growth of mind in animal life and its evolution in the social achievements of mankind culminated in studies of ethical development and in a theory of the possibility of social progress. His principal works include: *The Theory of Knowledge* (1896); *Mind in Evolution* (1901); *Development and Purpose* (1913); *Morals in Evolution* (1915); *Elements of Social Justice* (1921).

DAVID THOMSON

**HOBKIRK'S HILL, BATTLE OF**, an engagement of the Revolutionary War fought on April 25, 1781, near Camden, S.C. After the Battle of GULFORD COURT HOUSE General Greene marched against the British post at Camden. At Hobkirk's Hill north of the post his force of 1,200 was attacked by Lord Rawden with 900 men. Greene was defeated losing 264 men, but he retired in good order. The British lost 258. Nevertheless Rawden was forced to abandon Camden because of the loss of Fort Watson in his rear.

**HOBO**, a professional migrant, who generally wanders about the country in freight trains, existing by means of occasional work or charity. Hoboes insist that they differ from tramps in that they, the hoboes, are sometimes migratory or casual workers. During times when work is hard to find, as it was during the depression of the 30's, hoboes live in jungles along the railroad tracks in warm weather and in winter, if they fail to go south, they converge in such places as the Bowery in New York City or along Madison Street in Chicago. The unemployment situation and psychological problems are believed to be the chief reasons men sever family ties to become hoboes. **SEE LABOR, MIGRATORY.**

**HOBOKEN**, town, Belgium, in the province of Antwerp, on the right bank of the Scheldt River, four miles N of the city of Antwerp of which it is a suburb. Before World War II Hoboken was an important industrial center with shipbuilding yards. The town was badly damaged in September, 1944, during the siege of Antwerp by the British. Pop. (1955) 30,867.

**HOBOKEN**, city, New Jersey, Hudson County, on the Hudson River, opposite New York City. It is on the Hudson and Manhattan Railroad, is the terminus of the Delaware, Lackawanna and Western Railroad, and receives freight service from a number of other railroads. Ferries and the Hudson tubes connect Hoboken with New York City. A long water front extends along the river, providing excellent facilities for shipping. Several European lines use the great piers and make the port a terminus. During World War I, Hoboken was the chief embarkation port for the American Expeditionary Forces, 75 per cent of the troops leaving through the port. In World War II, the waterfront was used extensively for shipbuilding and the manufacture of steel. In addition to



shipyards there are railroad yards. The chief manufactures are food and electrical products, machinery, baking powder, tea and coffee, chemicals, paper, and scientific instruments.

Educational institutions include the Stevens Institute of Technology, established by the Stevens family, founders of the city; the Stevens Hoboken Academy; and the Academy of the Sacred Heart.

The land on which the city stands was a part of a grant of land which the Dutch West Indies Company gave to Michael Depauw in 1629. After the Dutch settlers were massacred by the Indians in 1643, the land was sold to Peter Stuyvesant, was owned by the Tory Bayard family, and was finally purchased by John Stevens in 1804. He laid out the city of Hoboken, naming it from *Hobocan Hackingh* (land of the tobacco pipe) for the pipes made by the Indians from stone found in the neighborhood. Both rail and steamboat navigation received an early impetus at Hoboken because of John Stevens' experiments. As shipping expanded, Hoboken attracted many foreign-born workers, and shipbuilding and other manufacturing interests dominated the city. In 1846, the first game of organized baseball was played here. The town was separated from North Bergen in 1855. Before its industrial expansion, Hoboken was for many years a favorite vacation resort for New Yorkers. One of the most congested of United States cities, Hoboken reached its population peak during World War I. Pop. (1950) 50,676.

F. C. W.

**HOBSON, RICHMOND PEARSON, 1870-1937**, United States naval officer, was born in Greensboro, Ala., and was educated at the U.S. Naval Academy (1889) and in Paris scientific schools. A lieutenant on the flagship *New York*, he won fame in the SPANISH-AMERICAN WAR by sinking the collier *Merrimac* at the entrance to Santiago Harbor (June 3, 1898) under the Spanish guns, for the purpose of blocking the exit of the Spanish fleet. He was taken prisoner with his crew of seven, but all were subsequently liberated by an exchange of prisoners. He retired from the Navy in 1903. From 1906 to 1915 he was a member of Congress. Later he campaigned in favor of prohibition and against narcotics.

**HOBSON, THOMAS, 1544?-1631**, the Cambridge carrier, immortalized by Milton in two humorous epitaphs. His insistence on each horse in his stable being taken out in turn gave rise to the expression "Hobson's choice"—i.e., "this or none."

**HOCCEVE.** See OCCEVE.

**HOCHKIRCH**, village, Germany, Saxony, five miles E of Bautzen. It is famous as the scene of a mighty battle (Oct. 14, 1758) between the Prussian forces under Frederick the Great and the Austrians, in which Field Marshal Keith was killed.

**HÖCHST**, formerly an independent municipality, in Hesse-Nassau, Germany, on the Main River. Since 1928 it has been an integral part of FRANKFURT AM MAIN.

**HÖCHSTÄDT**, town, Germany, in the state of Bavaria, on the left bank of the Danube River, 35 miles NE of Ulm. It was the scene of the defeat of Frederick of Staufen by Hermann of Luxembourg in 1081, of the Austrians by Marshal Villars in 1703, and of the Franco-Bavarian forces by Marlborough and Prince Eugene in 1704 (see *BLenheim*). Pop. about 2,000.

**HOCK**, a name given to any light white German wine. The majority of hocks are dry; but some are sweet or very sweet.

**HOCKEY**, a ball game, played on turf or ice. In either case, the players carry sticks curved at the ends, and attempt to drive a ball, or puck, through the opposite goal.

**Field Hockey** is an outdoor game played by 22 players, 11 on a side. The origin of the sport is shrouded in antiquity, knowledge of the pastime in a rudimentary form dating back more than 2,500 years. Although it was not until the past century that



VASSAR COLLEGE

**Field Hockey**, popular with both sexes in Europe, is almost exclusively a women's sport in the U.S.

a set standard of rules was drawn up for the game, field hockey has long enjoyed great favor in Europe. In France, during the Middle Ages, it was almost universally played and it was there that it got its name, the word hockey being a corruption of "hoquet," the French term for a shepherd's stick, which rather resembles the main implement with which the sport is played. The first organization to write rules for the game was the Men's Hockey Association of London, which assumed the task of guiding the sport in 1875. In 1883 the Wimbledon Hockey Club of England further standardized the pastime and that association has come to be recognized as the world's leading authority on the game.

Field hockey is played on turf, on a pitch 100 yards long by 50 yards wide. Exactly in the center of the field is drawn a line the width of the pitch, and each of the sections formed by this line is again divided in the center by a line called the "25-yard line." In the center of each end line are placed two goal posts, uprights seven feet high and four feet apart. A line four yards long is drawn 15 yards in front of each goal and this line is extended in a curve to form a quarter circle, with the goal posts as the center of a 15-yard arc. The space thus formed is called the *striking circle*. The sticks are about 3 feet 2 inches long and weigh from 18 to 22 ounces, and the ball is a regulation cricket leather ball painted white. It is the object of the game for one team to strike the ball between the goal posts of the opposing team as often as possible within the time limit.

Field hockey in the United States is almost exclusively a women's game, although it enjoys considerable popularity with both sexes in Europe. The sport was first played in America in 1901 when Miss Constance M. K. Applebee of the British College of Physical Education introduced it to Bryn Mawr, Mt. Holyoke, Radcliffe, Smith, Vassar and Wellesley. The introduction was accepted enthusiastically and in 1907 a league was formed. In 1922 the United States Field Association was organized in Philadelphia, and that body has come to be the governor of the game in the United States.

**Ice Hockey**, a development of field hockey, has far outstripped its forerunner in point of popularity with player and onlooker alike. The game had its origin in Canada, where it was first played in a most elementary form for several years before an attempt to draw up rules was made in 1879. It was in December of that year that the first recorded game of ice hockey was played between two teams made up almost entirely of McGill University students in Montreal. The contest took place on the frozen surface of the St. Lawrence River, and the players used canes, brooms and branches in place of the curved stick in use today. Fifteen players were on a side in that first encounter, although the rules pre-



EWING GALLOWAY

**Ice Hockey**, a popular sport which originated in Canada, is played on both indoor and outdoor rinks

viously drawn made provisions for only nine. This last number was adhered to in games played the following six years, during which time interest in the sport spread to many parts of the province of Quebec. In 1886 the playing number was reduced to seven on a side, and this alignment was kept for 30 years, when further revision brought about the six-man team which prevails today.

Formal organization of a governing body for the sport took place in 1887 with the organization of the Amateur Hockey Association of Canada. Thus established on a firm footing, the ice sport flourished in the Dominion, but it was not until the winter of 1894-95 that athletes from the United States played the game. In that winter a group of American college students visited Canada, participated in several games there and on their return home formed a number of clubs in the United States. Many Eastern colleges took up the sport and it grew so steadily in favor that it is now one of the most important activities on the winter sports calendar.

Aside from its prominence in the world of college sports, hockey also has burgeoned into an enterprise of great proportions in the professional field. With the ever-increasing construction of indoor rinks in which the firmness of the ice can be preserved indefinitely and where the spectators can look on in comfort, the game has been organized on a sound financial basis, and many leagues flourish in the northern United States and Canada. Hockey interest in these places in the winter season ranks quite as high as does enthusiasm for baseball in the summer. One of the strongest of the league groups is the National Hockey League which was organized in 1917 with four teams, the Montreal Wanderers, the Montreal Canadiens, the Ottawa Senators and the Toronto Arenas. The success of this group attracted the attention of sports promoters south of the border, and in 1925 the league was expanded to include several cities on the United States side of the border.

The acquisition of American territorial representation proved a good move for the league, for most of the teams met with instant financial success and the ability to pay large salaries attracted to its ranks the best players of the two countries. The solid foundation on which the league was based caused it, in time, to become the virtual dictator of matters pertaining to hockey, and, though it assumed no arbitrary powers, introduced a number of forward-looking rules changes which were adopted by college teams, and by other professional leagues as well.

Hockey, from its inception, has been an on-side game, but this phase of play has been reduced to a veritable minimum to sharpen spectator interest. For many years no player was permitted to pass to another who was at all in front of him. His relays, perforce, were either to the side or the rear.

## Hocking River

**Ice Hockey Rules.** The game is played on an ice surface called a rink, which should measure, as nearly as possible, 200 feet in length and 85 feet in width. Ten feet from each end of a rink, in the center of a line drawn across the width of the ice, stands a goal four feet in height, with an opening of six feet facing the center of the playing pitch. It is the purpose of the game to propel the puck, the object with which the game is played, into this goal. The puck is circular in shape, is constructed of vulcanized rubber, and is one inch thick and three inches in diameter.

Each team is manned by a center, a left wing, a right wing, a left defenseman, a right defenseman and a goalkeeper, all of whom must be shod with ice skates. It is the duty of the wings and center to force the play, that is, to carry the action into the zone of the opposing team. The defensemen's task is to keep the opposing wings and center, often termed forwards, from approaching the goals, while the goalkeeper, more frequently called goal tender, is set up as the last protective bulwark, whose assignment it is to remain close to his own goal and repulse all attempts made on the part of his adversaries to guide the puck into it.

Except for the goal tender, each player is equipped with a stick terminating in a blade of about 45 degrees from the haft. The sticks are of standard dimensions, extending 53 inches in length from the heel to the end of the haft, and 14¾ inches from the heel to the end of the blade. The hafts of these playing implements are one and one-half by three-quarter inches square, but the blade widens to two inches. The goal tender's stick, except for the top, is considerably wider than those used by the other players, measuring four inches across the haft and the blade.

The ice area is divided into three parts by lines drawn across the width of the pitch, 60 feet from the goal. The section nearest the defending team's goal is called the defending zone, the center section the neutral zone, and the part farthest from the defending goal is the attacking zone. At the start of the game the referee drops the puck in the exact center of the rink between the opposing centers, who try to take possession of it. A player in control of the puck guides it with his stick, and seeks to pass it to another member of his team. Passes in any of the three zones may be in a forward direction, but a pass over a sectional line causes play to halt automatically, and calls for the referee to drop the puck between the opposing centers at the point at which the off-side was committed. This action of the referee's dropping the puck is termed a face-off.

In college and league circles the playing time for a game is 60 minutes, divided into three periods of 20 minutes each. If the teams are tied in goals at the end of the regulation time, arrangements are made between the rival managers or captains for means of arriving at a decision. In most instances, where teams are tied, play is extended 10 minutes and if the score remains the same, hostilities come to an end. In championship games, however, overtime play is continued indefinitely until one team succeeds in scoring a goal. This extension of playing time is called "sudden death." Many penalties are in the rules which are enforced by the referee who controls a regulation contest. Among the fouls which draw penalties are unnecessary roughness, clipping, wielding a high stick, holding and fighting.

The symbol of the hockey championship of the world is the Stanley Cup, a trophy first put up for competition by Lord Stanley in 1893-94. Until 1912 the cup was played for by amateur teams but since that time professionals, having proved their eligibility in the terms of the deed of gift, have vied for it exclusively.

JOSEPH NICHOLS

**HOCKING RIVER**, Ohio, rises in Fairfield County and follows a southeasterly course of 80 miles to the Ohio River, which it enters 14 miles SW of Parkersburg, W.Va. Its valley is picturesque.



**HODDESON**, urban district, England, Hertfordshire, near the Lea River, 17 miles N of London. It is believed to occupy the site of a Roman village. St. Augustine's Church contains an altar tomb dating from 1473. Hoddeson was a coaching station on the Old North Road. The Bull posting house, where horses were changed, is mentioned by Matthew Prior, 17th-century poet, in his *Down Hall*. Izaak Walton's *Compleat Angler* mentions Hoddeson and the River Lea. Pop. (1950 est.) 12,100.

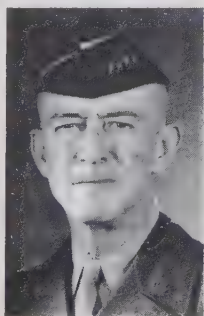
**HODEIDA**, city, SW Arabian Peninsula, chief seaport of Yemen, on the E coast of the Red Sea; 500 miles SE of Mecca. The harbor is available only for small craft, but steamer service is maintained with SUEZ, Massaua, ADEN, and other Red Sea ports. Chief exports are coffee, lambskins, hides, and fuller's earth. Hodeida was taken by Ibn Saud in 1934 in his attempt to conquer Yemen. Pop. about 42,000.

**HODGE, CHARLES**, 1797–1878, American Presbyterian theologian, was born in Philadelphia. He was graduated from Princeton (1815) and from the Princeton Theological Seminary (1819), where he became the first professor of oriental and biblical literature (1822). He was subsequently made professor of didactic and exegetical theology (1840) and, in addition, of polemical theology (1852). In 1825 he established the *Biblical Repository* (now the *Princeton Review*), which became the organ of old-school Presbyterianism, and which he edited until 1871, he himself contributing to it more than 140 articles, including a series of general assembly reviews which had a powerful influence on the church. His chief works are a *Constitutional History of the Presbyterian Church in the United States* (2 vols. 1839–40), *The Way of Life* (1842), and *Systematic Theology* (3 vols. 1871–73), one of the most important theological works ever written in America.

**HODGE, JOHN REED**, 1893– , American army officer, was born at Golconda, Ill. He entered the army as a second lieutenant (1917), served in France, and was promoted through the grades to lieutenant general, temporary (1945). He commanded the Americal Division when it relieved the 3rd Marine Division in the Battle of Bougainville (1943) and commanded the XXIV Corps in the invasion of Leyte (1944) and Okinawa (1945). He commanded the Army of Occupation in South Korea (1945–48), the Fifth Corps (1948–50), and became commander of the Third Army in 1950. DON RUSSELL

**HODGENVILLE**, town, Kentucky, county seat of Larue County, on the Illinois Central Railroad and U.S. highways 68 and 31E. The town grew as a farming center around a mill and tavern operated by Robert Hodgen in the early 19th century. Near by, the cabin in which Abraham Lincoln was born is protected in the ABRAHAM LINCOLN NATIONAL HISTORICAL PARK. Pop. (1950) 1,695.

**HODGES, COURTNEY HICKS**, 1887– , American army officer, was born in Perry, Ga., and studied at West Point (1904–5). He enlisted in the ranks, worked up to a commission, and fought in World War I, later serving in the occupation of the Rhineland. After an assignment to the Philippines as General MacArthur's plans and training officer (1936), he became assistant commandant (1938–40) and commandant (1940–41) of the Infantry School at Fort Benning, Ga. Appointed chief of infantry (1941), he advocated use of the rapid-firing carbine, the jeep, and the bazooka. He commanded the Third Army in the United States (1943) and was World War II commander of the First Army. He became a general in 1945 and retired



U.S. ARMY PHOTO

Courtney Hodges

in 1949. The following year he was appointed military adviser to Sir Owen Dixon, United Nations mediator on Kashmir.

**HODGKIN'S DISEASE**. In 1832 an Englishman, Thomas Hodgkin, described a peculiar disease which he had seen in several patients. All of them showed enlarged lymph glands and a large spleen. His study was so good and complete for the times that the disease has ever since been named after him. Hodgkin's disease may occur in any part of the world. It is most common in young people and more frequent in men than in women. The cause is not known. A good deal has been discovered about what tissues are attacked or altered in Hodgkin's disease. The parts susceptible are those making up the RETICULO-ENDOTHELIAL SYSTEM, such as the lymph glands and spleen. It has never been possible to show an infectious cause.

The typical early sign is enlargement of the lymph glands in the neck. It may be months or years before any other glands become involved. The patient usually feels well for a long time in most cases and then anemia begins to develop. There is generally very little pain, at least during the first stage of the disease. Fever may be present later, bronzing of the skin may develop, and the patient is likely to become thin and emaciated. Except in the very acute cases, the patient with Hodgkin's disease usually goes through periods of remarkable improvement. The enlarged lymph glands may disappear almost completely and the patient may feel almost completely well for a long time. In the long run the prognosis is grave.

The favored form of treatment has been either radium or x-ray and these have brought about long periods of almost complete recovery, especially when such treatment has been begun early. Drug treatment has not been very successful, although in recent years intravenous injection of extremely dilute preparations of the war gas known as nitrogen-mustard has been thought to be of some value. However, it is not curative. Radioactive isotopes, products of atomic energy, have an action similar to that of x-ray or radium. Certain of these, such as phosphorus, are taken up in large amounts by the reticulo-endothelial system.

EDWIN P. JORDAN, M.D.

**HÓDMEZÖVÁSÁRHELY**, town, SE Hungary, near the right bank of the Tisza River, 16 miles NE of Szeged. The town is protected from flood waters of the river by strong dams. As the center of a thickly populated agricultural district, the town has a large trade in livestock and diversified farm produce, including grapes and melons. Hódmezővásárhely was a refuge for inhabitants from surrounding villages, who fled before Turkish invasions (16th century). Destroyed by the Tartars in 1693, the town was resettled in 1699. Pop. (1949 est.) 58,000.

**HOE, RICHARD MARCH**, 1812–86, American inventor and manufacturer, was born in New York City. He worked with his father, Robert Hoe (1784–1833), a manufacturer of printing presses and other printer's equipment, and in 1830 took over control of the business. In 1846 he invented the type-revolving press, which consisted of a central cylinder to which the forms of type were securely fastened. The 4 to 10 impression cylinders which were grouped around this cylinder gave a running capacity of 8,000 to 20,000 pages per hour. The first newspaper to install this Hoe "lightning" press was the *Philadelphia Public Ledger* (1847). It became the predecessor of the modern rotary press.

Assisted by Stephen D. Tucker, Hoe improved the web press (1871), which had been first conceived of by WILLIAM A. BULLOCK. By using a rapidly drying ink he made it possible for this press to print simultaneously on both sides of a long sheet and to produce a maximum of 18,000 papers an hour. The output of newspapers was still further increased after he had perfected the collecting cylinder (1877) and the triangular folder (1881). See PRINTING.

**HOE, ROBERT**, 1839–1909, American inventor, grandson of Robert Hoe (1784–1833), was born in New York City. He was educated in the United States and in Europe, entered the Hoe printing press factory, and eventually became the head of the firm. He not only made improvements upon the Hoe press of 1846, but invented a rotary press, and a multicolor press. He was one of the organizers and the first president of the Grolier Club, devoted to the art of book making, and was the author of *A Short History of the Printing Press* (1902).

**HOEK VAN HOLLAND**. See **HOOK OF HOLLAND**.

**HOEVEN, IAN VAN DER**, 1801–68, Dutch naturalist, was born in Rotterdam. He studied in Leiden and Paris and in 1826 became professor of zoology at Leiden. He won European distinction by his *Handboek der Dierkunde* (3 vols. 1827–33), the second edition of which (1846–55) was translated into English as *Handbook of Zoology* (1856–58).

**HOF**, town, Germany, in the state of Bavaria, on the Saale River, N of the Fichtelgebirge, 42 miles NE of Bayreuth. It has a 16th-century town hall and a Gothic church consecrated in 1299. Industries include dyeing and stamping and the manufacture of woolens, cottons, linens, chemicals, machinery, leather, hardware, and beer. Hof, originally called Regnitz-hof, was first mentioned in 1080. It became a town early in the 13th century and in 1373 fell to the burgraves of Nuremberg. It became Prussian in 1806 and Bavarian in 1810. Pop. (1950) 60,867.

**HOER, ANDREAS**, 1767–1810, Tyrolese patriot, was born in St. Leonhard, in the Passeier Valley. He succeeded his father as an innkeeper (Am Sand) and cattle dealer, and on the transference (1805) of the Tyrol from Austria to Bavaria by Napoleon, headed a revolt, and drove the Bavarians from the country. Again, in 1809, after twice defeating the Bavarians and French and twice occupying Innsbruck, he won a third victory at Berg Isel. Eventually he was betrayed to the French in 1810, and carried to Mantua, where he was shot by order of Napoleon.

**HOER, KARL**, 1878–1955, German expressionist painter, born in Karlsruhe, Baden. He studied in Karlsruhe, Rome, and Paris, and served in World War I. From 1919 to 1933 Hoer taught at the State School for Free and Applied Arts, Berlin. Unpopular with the Nazi regime, he was then dismissed. In 1945 he became director of the High School of Fine Arts, in Berlin. Hoer's works include *The Wind*, *Girls with Melons*, *Early Hour*, *Girls Throwing Flowers*, and *Young People*. See **EXPRESSIONISM**.

**HOFF, JACOBUS HENRICUS VAN'T**. See **VAN'T HOFF**.

**HÖFFDING, HARALD**, 1843–1931, Danish philosopher, studied at the University of Copenhagen and was elected professor there in 1883. A positivist, influenced by Kierkegaard, he held to a distinction between knowledge and belief. His system of ethics was teleological and evolutionary; he was an associationist in psychology stressing the primacy of the will, and was opposed to metaphysical studies. His textbooks are widely used; the best of them include: *History of Modern Philosophy* (2 vols. 1900); *The Problems of a Philosopher* (1905); *Philosophy of Religion* (1906).

**HOFFMAN, CHARLES FENNO**, 1806–84, American poet and author, was born in New York City. He was educated at Columbia College and was admitted to the bar in 1827. Three years afterward he abandoned the practice of law, and thereafter devoted himself to editorial work and writing. He founded the *Knickerbocker Magazine* in 1833, and later the *American Monthly Magazine*, which he edited for several years. Afterward he was connected with the *New York Mirror* and the *Literary World* (1846). In 1849 he became insane, and for the remainder of his life was an inmate of a Harrisburg Asylum. He published *A Winter in the West* (1835), *Wild Scenes in Forest and Prairie* (1837), and *Grayslaer* (1840), but he is better known through his poems, collected in *The Vigil of*

*Faith* (1842), and his songs, notably "Rosalie Claire," and "Monterey." His complete poetical works were published in 1873.

**HOFFMAN, MALVINA**, 1887– , American sculptor, was born in New York City and studied sculpture with Adams, Borglum, Rodin, and Meštrović. In 1915 she won recognition for her "Pavlowa Gavotte" and her "Bacchanale Russe," and since that time her work has won many awards and has been acquired by a number of the world's great museums. From 1930 to 1935 she traveled over the world, studying racial types for the 101 life-size bronze statues commissioned by the Chicago Museum of Natural History. Among her other important works are "Russian Dancers" and "International Dance Fountain," the latter done for the New York World's



CHICAGO NATURAL HISTORY MUSEUM

**Australian aboriginal woman, by M. Hoffman**

Fair. She published the autobiographical *Heads and Tales* (1936) and *Sculpture Inside and Out* (1939).

**HOFFMAN, PAUL GRAY**, 1891– , American executive, was born in Chicago, Ill. His rise from salesman (1911) to vice-president (1925–33) of the Studebaker Corporation was interrupted by service in the U.S. Army during World War I. He was one of three Studebaker Corporation bankruptcy receivers (1933–35), served as firm president (1935–48), and was chairman of the Committee for Economic Development (1942–48), a nonprofit business group. He supervised the European Recovery Program as head of ECA (1948–50), resigning in November, 1950, to become the first president of the FORD FOUNDATION. He wrote *Peace Can Be Won* (1951).

**HOFFMANN, ERNST THEODOR WILHELM**, 1776–1822, German writer, artist, and composer, was born in Königsberg. He studied law at Königsberg and practiced there, in Berlin, and in Warsaw, where his career was cut short in 1806 by the invasion of the French. From then until 1814, when he established a legal practice in Berlin, he lived a restless, bohemian life, working as a theater director, scene painter, caricaturist, writer, composer, and music teacher, and acquiring the dissolute habits which brought about his death. In Berlin he became a member of a literary circle that included Fouqué, Chamisso, and Hitzig, and, while continuing his legal practice and heavy drinking, worked steadily at writing and composing. Besides the opera *Undine* (1816),



his best known works are lurid, macabre tales and novels, as *Fantasies in the Style of Callot* (1814), *The Devil's Elixir* (1816), *Night Pieces* (1817), and *The Serapion Brethren* (1819-21). Under the name Johannes Kreisler, he wrote distinguished musical criticism, notably studies of Bach and Beethoven. His sketches and caricatures, like his fiction, are grotesque and garish. Three of his characteristic stories were adapted for the libretto of Offenbach's opera, *The Tales of Hoffman*.

**HOFMANN, AUGUST WILHELM VON**, 1818-92, German chemist, was born in Giessen and studied at the university there where he became assistant to Baron Justus von Liebig. In 1845 he went to England to become professor of chemistry in the newly established Royal College of Chemistry. He returned to Germany in 1863 to accept the professorship of chemistry at the University of Berlin. His researches were especially fruitful in the domain of organic chemistry, and he practically revolutionized the art of dyeing through the discoveries which he made in the preparation of numerous coloring matters from coal tar products. He founded the German Chemical Society (1868).

**HOFMANN, JOSEF CASIMIR**, 1876-1957, Polish composer and pianist, was born in Podgórze, near Kraków, and became an American citizen in 1926. His father was conductor of the Warsaw Opera; his mother a distinguished singer. His father and Anton Rubinstein were his teachers. Josef began his recitals at the age of six and toured Europe as a child prodigy. In 1894 he made his professional debut in Dresden, and made a successful tour in America in 1898. After that he lived chiefly in the United States, where he performed with all the great orchestras and gave numerous concerts. He was better known as a pianist, but wrote piano concertos, sonatas, and a Symphony in E. Under the name of Michel Dvorsky he wrote many excellent smaller compositions for piano and two pieces for orchestra. He wrote two books: *Piano-Questions Answered* (1909) and *Piano-Playing, with Piano-Questions Answered* (1914).

ANNE AND MARK OBERNDORFER

**HOFMANNSTHAL, HUGO VON**, 1873-1929, Austrian poet and dramatist, was born in Vienna. He belonged to the Stefan George circle at first. In a sensitive, impressionistic style, he gave a picture of a tired, resigned old Austria in his poetry (*Die Gedichte und kleineren Dramen*, 1907) and dramas (*Der Tod des Tizian*, 1892; *Der Tor und der Tod*, 1894). He is best known as the librettist for operas by Richard Strauss: *Electra* (1904), *Oedipus und die Sphinx* (1906), *The Rosenkavalier* (1911), *Ariadne at Naxos* (1912).

HARRY SLOCHOWER

**HOFSTRA COLLEGE**. See COLLEGES.

**HOFUF**, or **El Hofuf**, city, Saudi Arabia, capital of the E coast province of Hasa, at the S end of the Hasa Oasis; 45 miles W of the Persian Gulf. It is noted for its Arabian horses and white donkeys. Large quantities of *Khalas* dates are exported. Pop. about 30,000.

**HOG**. See **PIG**.

**HOG ISLAND**, in the Delaware River, NE United States, is a transportation and industrial center for near-by Philadelphia. During World War I, an important government shipyard was located there.



COURTESY OF THE TRUSTEES OF THE TATE GALLERY

From "Marriage à la Mode," a satirical series by Hogarth

**HOGARTH, WILLIAM**, 1697-1764, British painter and engraver, was born in London, the son of a poor schoolteacher who had come to the city with the hope of bettering his fortune. He early showed a talent for drawing and his ambition was to become an engraver of copperplate prints. The first step in his career was his apprenticeship to a silversmith, but in 1720 he was in business for himself, not only as an engraver on silver but of shop bills, trade cards, and coats of arms. Sir James Thornhill had lately opened his art school and there Hogarth occasionally attended classes to become more expert in drawing from life.

**Growth and Spread of Satirical Powers.** Soon Hogarth's satirical engravings began to appear, and in 1726 the 12 plates for Butler's *Hudibras*, which he never excelled in his later attempts at illustrations, were published. An accusation that he was "an engraver, but no painter" brought on a lawsuit which he won and he began painting the small portrait groups which were later known as "conversation pieces." In 1729 he eloped with Sir James Thornhill's daughter who married him. His satirical and humorous powers were now at the full stage of development and two years later he had completed his great moral work, "A Harlot's Progress," consisting of six paintings. Five of these are lost but all have been immortal from the widely circulated set of engravings he made of them. In 1735 "The Rake's Progress," eight engraved plates which were a sequel to the earlier series, appeared, but with less success. By this time Hogarth was established as the great pictorial castigator of his age; his fame was secure—he was either greatly admired or violently hated by all of his contemporaries.

**Other Works.** Hogarth had brought new spirit to English art, freeing it from the imitation of foreign masters in which it was stifled when he was born. As he was an extreme nationalist, it would please him that all his most important works have remained in England. There are the six paintings of "Marriage à la Mode" (National Gallery, London); "The Election" (Sloane Museum, London); the great portraits, "The Shrimp Girl" and "The Self Portrait with His Dog Trump" (both in the National Gallery), "Lord Lovat," "David Garrick as Richard III," "Lavinia Fenton as Polly Peacham in 'The Beggar's Opera.'" His last years were not peaceful, due to a quarrel with his friends, John Wilkes and the poet Churchill, involving their criticism of Hogarth's essay *The Ana-*

*lysis of Beauty* which had been printed in 1753. In March, 1764, he published his last print, "The Bathos," which was to serve as a tailpiece for his entire engraved work; he died in October of the same year. The small house where he spent his summers from 1749 till his death was purchased in 1902 and established as a Hogarth museum.

**Technique.** During his lifetime, and for many years after, Hogarth's fame lived on the popularity of his engravings. He brought the reality of the commonplace into the realm of great art. As Daumier did with the caricature and Toulouse-Lautrec with the poster, he elevated the satirical print to a position that gave it a timeless superiority. His method of composition was simple: one can almost feel that one is in a theater; there are the backdrop, wings, and proscenium; effects of mass and volume are created more by lighting than by line; and everything is concentrated on the human beings on the stage. But the characterization is always true and his satire can sometimes be deep enough to suggest the great Goya, who was to follow him. He has been accused of being "too literary," "too didactic," and one recognizes in him the beginnings of that element of anecdote and storytelling which became the dull obsession of so many lesser 19th-century English artists. However, in the last few years, because of greater attention paid his neglected work as a painter, he has grown into something other than the man whose works "are to be read more than to be seen"; and in his original use of tonalized color, his rapidly set down suggestions, he is so successful in pleasing the lover of "pure" painting that there are now some critics who see in his works the first hints of impressionism. See **ENGLISH ART**; **WEAVING** for illustrations.

HUGH EDWARDS

**BIBLIOG.**—Marjorie Bowen, *William Hogarth: The Cockney's Mirror* (1936); F. D. Klingender, ed., *Hogarth and English Caricature* (1945).

**HOGG, JAMES**, 1770–1835, Scottish poet, was born in the valley of the Ettrick, Selkirkshire, and became known as "The Ettrick Shepherd," since he tended his father's sheep at an early age. When he was 20, he found similar employment with a Mr. Laidlaw, who encouraged his yearning toward literary expression. While selling sheep in Edinburgh, he arranged for the publication of his *Scottish Pastorals, Poems, Songs, etc., Mostly Written in the Dialect of the South* (1801). A year later he assisted Sir Walter Scott in finding material for *Border Minstrelsy*, and Scott's intercession secured the publication of *The Mountain Bard* (1807). *The Queen's Wake* (1813), a sequence of verse tales including "Kilmeny," usually is regarded as Hogg's most impressive work. He achieved considerable financial success, but lost all his money in a series of farming ventures. He did a great deal of hack work for publishers, and wrote for *Blackwood's Magazine*. Among his prose works are *Winter Evening Tales* (2 vols. 1820), *The Three Perils of Man* (3 vols. 1822), *The Private Memoirs and Confessions of a Justified Sinner* (1824), and *The Domestic Manners and Private Life of Sir Walter Scott* (1834). Hogg figures as one of the interlocutors in Christopher North's *Noctes Ambrosianae*.

**BIBLIOG.**—E. C. Batho, *The Ettrick Shepherd* (1927).

**HOGNOSED SNAKE**, any of a number of species of nonpoisonous North American colubrine snakes belonging to the genus *Heterodon*. The common hognosed snake or puff adder, *H. contortrix*, measures not more than three and a half feet in length. It is pale brown, black, or gray with irregular dark blotches on the back and black dots on the sides and abdomen. The turned-up snout resembles that of a pig. When annoyed, hognosed snakes flatten the head and neck in cobra fashion, hissing loudly. Their appearance at this time is so formidable that many erroneously believe them to be poisonous.

**HOGUE**, or **La Hougue**, small harbor, France, in the department of Manche, 15 miles E of Cherbourg.

Here, in 1692, the English under Admiral Russell defeated the combined French and Dutch fleets under Tourville.

**HOHENHEIM**, village, Germany, in the state of Württemberg, five miles S of Stuttgart. Originally a possession of the Bombast von Hohenheim family of which Paracelsus was a descendant, the village came into the possession of Duke Karl Eugen von Württemberg in 1768. He rebuilt the pleasure castle of Hohenheim in 1782. The village is the seat of an agricultural college renowned in Germany.

**HOHENLINDEN**, village, Germany, in the state of Bavaria, 20 miles E of Munich. It was the scene of the victory of the French under Moreau over the Austrians under Archduke John on Dec. 3, 1800. The poet Campbell has commemorated the battle in his lyric *Hohenlinden*.

**HOHENLOHE-SCHILLINGSFÜRST, CHLODWIG KARL VIKTOR, PRINCE OF**, 1819–1901, German statesman, born in Bavaria; was early known for his Prussian sympathies. After Sadowa he was appointed (1866) chief minister of Bavaria, and tried to bring about the union of southern and northern Germany, but was forced by the clerical party to resign (1870). He advocated the alliance of Bavaria with Prussia in the Franco-Prussian War. In 1874 he became German ambassador to Paris, where he remained until 1885. As governor of Alsace-Lorraine (1885–94) he pursued a conciliatory policy. In 1894 he was appointed chancellor and endeavored to cushion the shocks caused by the whimsical aberrations of William II. He resigned in 1900. His highly interesting memoirs, posthumously published in 1906, aroused the wrath of the emperor and provoked a scandal in the political circles of Germany.

**HOHENSTAUFEN**, name of a German imperial dynasty from 1138 to 1254. The first known member was Frederick of Büren in Swabia. His son Frederick was made duke of Swabia for his fidelity to the Emperor Henry IV. His grandson was crowned king of Italy (1128), and on the death of Lothair was elected emperor as Conrad III, handing on the empire to his nephew, Frederick Barbarossa. The next emperors of his family were Henry VI, Philip, and Frederick II, whose son, Conrad IV, was the last emperor of the house of Hohenstaufen, which practically became extinct with Conradin, who was put to death by Charles of Anjou in 1268. The history of the family is one long contest with the Gueffs and the papacy, ending in the triumph of the latter. See **GERMANY, History**.

**HOHENZOLLERN**, German imperial dynasty, takes its name from the castle of Hohenzollern in Swabia, and traces its origin to Tassillon, who lived under Charlemagne. A younger son of the house, Conrad, sought service under Frederick Barbarossa, becoming burgrave or imperial steward of Nuremberg, about 1170. In 1226 the family split into the Franconian and Swabian branches. In 1248 the burgrave of Nuremberg was Frederick III, head of the Franconian line, who contributed to the election of Rudolf of Hapsburg as emperor. In 1346 Burgrave John II became governor of Brandenburg, of which subsequently Burgrave Frederick VI was first elector (1415). In 1701, Frederick III, elector of Brandenburg, became first king of Prussia. In 1871 the king of Prussia became German emperor. The collateral Swabian line, founded by Frederick, count of Zollern, was (1576) divided into the Hohenzollern-Hechingen and the Hohenzollern-Sigmaringen lines. Owing to the troubles of 1848, Prussia was able to absorb these independent principalities. The proposal to raise Prince Leopold of Hohenzollern-Sigmaringen to the throne of Spain was the immediate cause of the Franco-Prussian War. The last actual ruler of the line was William II until 1918. Descendants of the Swabian line are the kings of Rumania from CAROL I on. See **GERMANY, History**; **PRUSSIA**.

**HOHENZOLLERN CANAL**. See **CANAL**.



**HOIHOW**, city, China, chief port on the N coast of the Island of HAINAN, Kwangtung Province, on Hainan Strait, near the capital city, KIUNGSHAN. Hoihow and Kiungshan were occupied by the Japanese from Feb. 12, 1939, until Oct. 15, 1945. At Hoihow the Japanese built an airfield which was used as a base for raids on the Chinese mainland. Pop. about 25,000.

**HOIST**, any device for raising and lowering heavy loads. Essentially a hoist consists of a rope, cable, or chain, one end of which is wrapped around a drum or drive sheave. Rotation of the drum winds or unwinds the rope, thus raising or lowering the load attached to the other end. The drum may be driven by any of a number of power sources including compressed air, internal combustion, hydraulic, or steam engines, or electricity. The power source is connected to the drum through a suitable speed reducing, torque-increasing mechanism which includes a brake for controlling the speed of operation.

A hook, grapnel, magnet, or other device may be used to attach the load to the rope, or the load may be permanently attached as in the case of the elevator car, mine cage, or skip. The electrically operated hoist is most commonly used today in installations ranging from high speed passenger elevators in office buildings to chain hoists of various capacities used in industrial operations. Steam driven hoists are also used both in stationary installations for moving heavy loads and for portable hoisting.

The rope used for hoisting operations is either high quality manila for lighter loads or multiple strand, greased, flexible wire rope for heavy operations. In principle, various hand operated lifting devices, such as the winch, capstan, screw jack, hydraulic jack, and chain block may be classified as hoists.

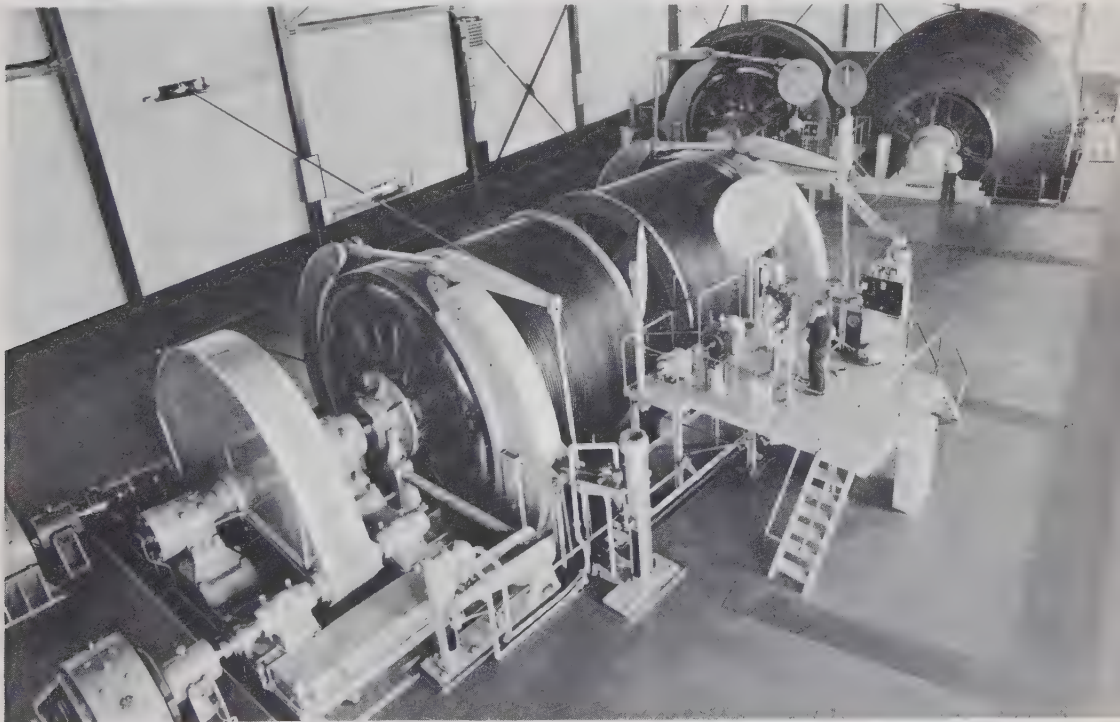
An especially highly developed hoist is the cylindro-conical type used in coal mine operation. It receives its name from the shape of the drum on which the rope is wound. Two skips for hoisting coal are hung side by side in a shaft and operate in balance, one going down while the other comes up. While the rope is winding on one side of the drum it is un-

winding on the other, thus equalizing the load on the motor which powers the hoist. The greatest load on the motor is at the time it starts to lift the loaded skip at the shaft bottom with 500 or more feet of steel rope hanging in the shaft. To offset this starting load the hoist drum is so made that the loaded rope starts winding on the small diameter where the hoist has the greatest power but slowest speed, but the rope to which the empty skip is attached is helping the motor by pulling on the drum on the large diameter where it has the greatest effect. A drum of this type effects a saving in power of more than 20 per cent over the ordinary cylindrical type. Such a hoist is driven by a 350 horsepower motor and can reach a speed of 3,000 feet a minute. Safety devices to prevent overspeeding and overwinding automatically set the hydraulically operated brake. The complete hoist weighs 40 tons. D. M. MACMASTER

**HOKIANG**, province, China, in E central MANCHURIA, bounded on the E by the Ussuri River and the U.S.S.R.; on the NE by the Heilungkiang (Amur) River, and the U.S.S.R.; on the NW by Heilungkiang Province; on the S and SW, by Sunkiang Province; area 100,000 sq. mi.; pop. (1947 est.) 1,298,000. The province is mountainous in the northwest (Little Khingan Mountains) and southeast (Wanta Shan); a few peaks reach 4,000 feet. The chief inland rivers are the Sungari and its tributary, the Hurka. There are extensive forests of red pine, fir, spruce, and larch; and pasture lands for grazing large herds of cattle. Though the climate is cold, the province is agricultural. Millet, corn, barley, and tobacco are grown. Hokiang is one of six provinces created in 1945 from the former Heilungkiang and Kirin provinces. The capital and chief city is Kiamusze, on the Sungari.

**HOKITIKA**, town, New Zealand, Westland Provincial District, on the W coast of South Island, 22 miles by rail S of Greymouth. In 1865 a gold strike was made in the area, and gold is still mined. Pop. (1945) 2,742.

**HOKKAIDO ISLAND**, formerly **Yezo**, northernmost of the Japanese home islands, extends from



GOODMAN MFG. CO.

Simple drum hoist in foreground; specially developed cylindro-conical hoist in background

about 43° 30' N to 41° 30' N lat. and from 139° 45' to 145° 55' E long.; area about 33,310 sq. mi.; pop. (1940) 3,272,718. Hokkaido was the term formerly used for the northern part of the Japanese Empire and included the island itself, Karafuto (the southern half of Sakhalin), and the Kurile Islands, but has latterly been used to designate only the island. Hokkaido was little more than a frontier wilderness, populated principally by AINU until 1870, when the Japanese began to develop the timber and iron resources of the large island. Railways were built and Honshu farmers were offered inducements to leave their crowded areas for Hokkaido. The effort, because of an average annual temperature of only 40° F., was only moderately successful, little more than half the four million arable acres being cultivated and the population averaging only two per square mile. Most of the growth has centered in port and railway cities along the southern and southwestern shores, rather than extending to the inland plains. There are AINU settlements near Asahigawa and at Shiraoi, near Muroran.

The industry deals with the raw material of the island and the near-by seas. There are lumber, iron and steel, and textile mills, fish canneries, cement plants, and manufactures of farm implements. Large bean and sugar-beet crops are grown. Hokkaido's development has been partly through Japanese-employed American engineers. SAPPORO (pop. 222,827), capital and chief city, was modeled after Washington, D.C. HAKODATE (pop. 203,862), the principal port, lies only 20 miles across Kaikyo Strait from the northernmost extension of Honshu. MURORAN (pop. 107,628), the steel producing center, was shelled by American naval vessels during World War II. P. W.

**HOKUSAI, KATSUSHIKA**, 1760-1849, eminent Japanese painter, was born in Honjo, in Yedo (Tokyo), the son of a tradesman. He got little encouragement at first, and for a time was obliged to earn his living as a peddler, but in 1807 an association with Bakin, as illustrator for a Chinese novel the

the *École des Beaux-Arts* (1913). As a member of the firm of Holabird and Root, he aided in the design of the Daily News Building, the Palmolive Building, and the Board of Trade Building, all in Chicago, and the Statler Hotel, Washington, D.C.

**HOLABIRD, WILLIAM**, 1854-1923, American architect, father of JOHN AUGUR HOLABIRD, was born in Amenia Union, N.Y. He is remembered for his pioneer work, with the firm of Holabird and Roche, in the use of skeleton frames for tall buildings, as in the Tacoma Building, finished in July, 1888. Among the other buildings designed by Holabird and Roche are the Congress Hotel, Boston Store, Hotel LaSalle, and John Crerar Library, all of which are in Chicago.

**HOLBACH, PAUL HENRI DIETRICH, BARON D'**, 1723-89, French philosopher and encyclopédiste. He contributed extensively to the *Encyclopédie*, mainly on scientific subjects. In philosophy he followed Diderot, and in his *Système de la Nature* (1770) pushed his antireligious principles to such extremes that he even shocked Frederick the Great and Voltaire, though the violence of his views was mitigated by the sincerity of the author, and his passion for religious and political liberty. He was the model of Von Wolmar in Rousseau's *Nouvelle Héloïse*. Most of his works were printed anonymously or under a fictitious name at Amsterdam.

**HOLBÄK**, county, Denmark, on the NW corner of Sjælland (Jalland); bounded on the N by the Kattegat, on the W by the Great Belt, on the S by Soro County, and on the E by the Ise Fjord and Københavns County. The capital is Holbæk.

**HOLBEIN, HANS, THE ELDER**, c. 1460-1524, German painter, stained-glass designer, and wood engraver, was born in Augsburg, Bavaria. His style was at first derived from the Dutch, the Swabian school of Augsburg, and the Alsatians; and later was influenced by the Italian Renaissance painters. Holbein's works, principally concerned with religious subjects, are remarkable for deep and resplendent coloring, keen characterization, and a movement at once violent and static. His best-known works include the altar of St. Sebastian and 16 panels on the "Life of the Virgin Mary," both in the old Pinakothek, Munich; an altar on the "Life of the Virgin" (Augsburg Cathedral); and the paintings "Christ Crowned with Thorns" and "Bust Portraits of Boys," both in the Basel Museum, Basel.

**HOLBEIN, HANS, THE YOUNGER**, c. 1497-1543, German painter and engraver, son of HANS HOLBEIN THE ELDER, was born in Augsburg, Bavaria. He was apprenticed to his father and in 1515 went to Basel with his elder brother, Ambrosius (1494-c. 1518), also a painter. In Basel and Lucerne, Hans Holbein was employed in portraiture, painting frescoes, and illustrating books. He, and probably Ambrosius, illustrated Erasmus' *In Praise of Folly* (1515-16), and in this period Hans Holbein did the drawings of *Dance of Death*, known through the woodcuts of Lützelberger (c. 1526). In this series Holbein represented with biting satire persons of diverse vocations and economic strata—all of whom were terrorized by death. Boldness of design, fertility of imagination, close observation, and realistic method distinguished Holbein's work.

He went to London (1526), furnished by Erasmus with an introduction to Sir Thomas More, and there found ample employment as a portrait painter; as such he attained his mature reputation. A number of his finest pictures were painted prior to his first visit to England. Among these were the portrait of Erasmus (Longford Castle); "The Last Supper" and eight scenes from "The Passion" (both in the Basel Museum), which show the unmistakable influence of Leonardo da Vinci; "The Virgin and Child with St. Martin and St. Ursus," dated 1522; the beautiful doors of the minster at Basel; and the celebrated Meyer "Madonna" (Darmstadt), a fine replica of which is in Dresden. At Windsor there is a collection



"Kosho Isawa Fuji," by Katsushika Hokusai

latter had translated, resulted in his getting some recognition. By 1810 he had become more generally known, and once he was established as a teacher, he soon had so many pupils that he had to resort to wood engraving to supply them with his original drawings for copying purposes. This resulted in his *Mangwa*, or "Ten Thousand Sketches," which established his fame. His productive power was astonishing; no less than 30,000 of his drawings have been listed, but he was a spendthrift, was always in want, and was buried by his friends and pupils. He used many signatures on his work. There is a complete list of his works in Anderson's *Descriptive and Historical Catalogue of Chinese and Japanese Art* (1886).

**HOLABIRD, JOHN AUGUR**, 1886-1945, American architect, was born in Evanston, Ill., and graduated from the U.S. Military Academy (1907) and





"The Ambassadors," a painting by Hans Holbein the Younger

NATIONAL GALLERY, LONDON

**HOLBORN.** See LONDON.  
**HOLBROOKE, JOSEF,** 1878–, English composer, was born in Croydon, near London. His early years were spent traveling with a musical troupe, of which his father and mother were members. After his mother's death, his father settled in London, and the boy began his serious education at the Royal Academy of Music. Because he substituted one of his own compositions for that on a program, the Academy requested him to leave. In 1900 his composition, *The Raven*, was performed with great success in London. Many of his later symphonic poems, such as *Ulalume*, *The Bells*, and *The Masque of the Red Death*, were also based on the works of Poe. The most well-known of his compositions are his orchestral variations of *Three Blind Mice*. Although he is now acknowledged to be one of the outstanding modern composers of England, many of his works are considered sensational and even grotesque.

of 87 portraits of noted men of the period drawn in colored chalk on tinted paper; most of these were engraved by Bartolozzi and published by Chamberlaine (1792–1800).

Holbein visited Basel (1528–32), and on his return to England he found powerful patrons in the German merchants of the Steelyard and painted the portraits of many of them. About this time Holbein became known to Henry VIII and painted for him "Henry VII with Elizabeth of York, and Henry VIII with Jane Seymour and Children," the great family picture that perished in the fire at Whitehall (1698), and the portrait "Jane Seymour" (Vienna). Upon the death of Jane Seymour (1537), Holbein was sent by Henry VIII to paint the portraits of Anne of Cleves and Christina of Denmark.

Holbein excelled as a miniature painter and also executed a series of important cartoons in India ink for glass painting. Holbein developed his own style of painting out of the Augsburg tradition. He had remarkable accuracy and a rare gift for selection of detail. See DANCE OF DEATH; DRAWING; EDWARD VI; GERMAN ART for illustrations.

H. O.

**HOLBERG, LUDWIG, BARON,** 1684–1754, Danish poet and dramatist. In 1706–8 he lived in England, where he adopted the English rationalistic philosophy, and after some years of travel he returned to Denmark (1716) where in 1719 he published the first part of *Peder Paars*, a mordantly witty satire. In 1722 he wrote his first five comedies, the last of which, *Den politiske Kandestöber*, was acted in 1722, at the first Danish playhouse, just opened. From 1723 he contributed no fewer than 28 masterpieces to the repertory of the theater until it closed in 1727, and years later six more. His *Danemarks Riges Historie* (1732–35), *Almindelig Kirkehistorie* (1738–40), and *Berømmelige Moendsog Hjeltes Sammenlignede Historier* (1739), constitute his best work in this field. The satirist re-emerges in *Nicolai Klimii Iter Subterraneum* (1741), a sarcastic romance, somewhat in the manner of *Gulliver*. The work of his old age was the *Epistler* (1748–54), a striking testimony of the breadth of his knowledge.

**HOLDENVILLE,** city, E central Oklahoma, county seat of Hughes County; on the Rock Island and the Frisco railroads, and U.S. Highway 270, about 75 miles SE of Oklahoma City at the eastern edge of the Seminole oil field. Holdenville is a farm trading center which grew up about a railroad station, first surveyed in 1895 and known as Fentress. The 550-acre Lake Holdenville is near by. Farms in the area specialize in cotton, corn, and watermelons. The city has meat packing plants, creameries, cotton gins, and oil refineries. Pop. (1950) 6,192.

**HÖLDERLIN, JOHANN CHRISTIAN FRIEDRICH,** 1770–1843, German poet, was born in Lauffen. He studied with Hegel and Schelling at Tübingen, where he became a protégé of Schiller. He had completed a novel, *Hyperion* (1799), and begun a tragedy, *Der Tod des Empedokles*, when he lost his mind through an unhappy love affair. In lucid intervals he translated several Greek plays but became completely deranged and was permanently confined at Tübingen in 1807. His passionate interest in Greek culture, a survival of the Storm and Stress spirit, is manifest in the background of his novel and in the substitution of classic measures for rhyme in his poems.

**HOLDING COMPANY,** a corporation organized for the purpose of owning and holding the stock of other corporations. It may acquire only a part or all of the stock of another corporation. When the holding company owns a majority or all of the stock of the subsidiary company, its board of directors is in a position to manipulate or control the subsidiary corporation. Some legal restrictions have been placed upon holding companies owning all or a majority of a substantial number of competing transportation or manufacturing companies and thereby restraining competition and fostering monopolies. See COMBINATIONS AND MERGERS; MONOPOLY; TRUSTS AND TRUST REGULATION.

**HOLGUIN,** city, Cuba, in the province of Santiago de Cuba, 65 miles NW of the city of Santiago de Cuba. It is pleasantly and healthfully situated on hills in a fertile sugar and tobacco raising territory. Sugar and

tobacco products are exported through Gibara, its port, 25 miles northeast. Pop. (1943) 35,865.

**HOLIDAY, HENRY**, 1839–1927, British artist, was born in London and studied at Leigh's and at the Royal Academy. He achieved success in figure painting and later in the designing of glass windows which became his chief work. His best known picture "Dante and Beatrice" was painted in 1883. Among the most notable of his glass windows are those in Trinity College, Cambridge and those in Trinity Church, New York.

**HOLIDAY**, a day on which business ceases in honor of an individual or of a religious or national event. Originally holidays were holy days devoted to religious festivals, but as the church became separate from the state the number of holidays celebrating various saints or ecclesiastical occurrences declined in favor of holidays of national or patriotic significance.

Public holidays in the United States are declared by the various state governors or state legislatures. With the exception of April 30, 1889, the 100th anniversary of the Constitution, there has never been a national holiday in this country, i.e. one proclaimed by Congress. As a result there are only seven public holidays observed by all the states. They are New Year's Day, January 1; Washington's Birthday, February 22; Independence Day, July 4; Labor Day, the first Monday in September; Armistice Day, November 11; Thanksgiving, the fourth Thursday in November; and Christmas, December 25.

The chief holidays of England are called bank holidays and include Easter Monday; Whit Monday, the first Monday in August; Boxing Day, the first week-day after Christmas; Good Friday; and Christmas, December 25. Russians take a vacation from work December 22, "Bloody Sunday," the anniversary of the beginning of the general strike in Leningrad in 1905; January 22, Lenin Memorial Day; May 1, International Working Class Day; November 7, the anniversary of the Great October Socialist Revolution; and December 5, Constitution Day. Canada celebrates 10 public holidays: New Year's Day, January 1; Good Friday, the Friday before Easter; the Monday after Easter; Victoria or British Empire Day, May 24; the King's Birthday, on the birthday of the reigning sovereign, or on a day fixed by proclamation, usually June 9; Dominion Day, July 1; Labor Day, the first Monday in September; Thanksgiving, usually the second Monday in October; Remembrance Day, November 11; and Christmas, December 25.

Many religious sects continue to observe religious holidays with ceremonial rites. However, since they became more secularized, holidays are often only times of rest and recreation. (See DAY; DIES NON.) For religious holidays see FEAST. For further information concerning particular holidays see individual entries.

**HOLINESS CHURCHES**, a class of Christian denominations stressing the doctrine of "complete sanctification" and the direct action of the Holy Spirit. Some call themselves missionary or evangelistic associations. Most are derived from Methodist origins. More than 20 such groups are listed. At least 10 have "Church of God" as part or all of their name. Among these are the CHURCH OF GOD (CLEVELAND, TENN., organized in 1886) with 106,490 members; CHURCH OF GOD (ANDERSON, IND., 1880), 105,022 members; Church of God and Saints of Christ (Negro), 34,610 members; CHURCH OF GOD IN CHRIST, 340,530 members; and CHURCH OF THE NAZARENE (founded in 1907), 220,042 members.

W. E. GARRISON

**HOLINSHED, or HOLLINGSHEAD, RAPHAEL**, c. 1520–80, English chronicler, about whom little is known. He lived in London in the reign of Elizabeth as translator for the printing press of Reginald Wolfe, and when Wolfe planned a *Universal*

*History*, the main part of the work (relating to the British Isles) was entrusted to Holinshed, although William Harrison wrote a description of contemporary England. Holinshed's own *Chronicle* was largely based on the earlier chronicle (1550) of John Halle. The first edition appeared in 1577. In 1587 a second was prepared, with a continuation by John Hooker (alias Vowell), Abraham Fleming, Francis Thynne, and others. A new edition appeared in 1807–9. His *Chronicle* was one of the sources upon which Shakespeare drew for his historical plays.

**HOLISM**, a system of thought derived from the book written by JAN CHRISTIAAN SMUTS, *Holism and Evolution* (1926). Holism is opposed to dualism, maintaining that in all regions of experience the elements of any organic unity are conditioned as much by the whole as the whole is conditioned by the elements. Phenomena of all sorts must be studied and understood in terms of their organic unity, not merely in terms of the parts. Holding to this view, holism emphasizes integration, connection, and unity rather than separation, independence, and heterogeneity of elements. The universe is conceived as a process of creative synthesis in which the wholes of which it is composed are creative, evolutionary, and dynamic.

The influence of holism has been widespread. Individual psychology as developed by ALFRED ADLER rests upon a foundation of holism in its conception of the individual. The theories of JOHN DEWEY, which emphasize the unity and continuity of body, mind, nature, and society, are very much in line with the principles of holism. The psychosomatic approach to mental and physical disorders, which considers mind and body as a unit, is also based upon the theories of holism. The school of GESTALT PSYCHOLOGY, with its emphasis upon the whole, rather than the parts, of conscious or behavioral phenomena, has much in common with holism.

BIBLIOG.—L. Morgan, *Life, Mind, and Spirit* (1926).

**HOLLADAY OVERLAND STAGE**, a system of transportation to the Far West before the construction of the railroads. In 1862 Benjamin Holladay bought at public auction part of the system of Russell, Majors, and Waddell. He greatly extended his lines after the end of the Civil War, covering 3,300 miles in all; he used some 6,000 horses and mules, 260 coaches, and hundreds of men. He was paid \$650,000 annually by the Federal government for carrying the mails over his lines. Fares were \$175 from the Missouri River to Denver, \$350 to Salt Lake City, and from \$400 to \$500 to California, but even so the coaches were crowded with passengers after the war. In 1866 Holladay sold his lines to WELLS, FARGO AND COMPANY for \$2,500,000. See STAGECOACH.

**HOLLAND, CLIFFORD MILBURN**, 1883–1924, American tunnel engineer, was born in Somerset, Mass., and educated at Harvard University. In 1914 he became tunnel engineer for the Public Service Commission of New York, designing and building the double subway tunnels under the East River. In 1919 he became chief engineer for the New York State and New Jersey Interstate Bridge and Tunnel Commission, building the Hudson River Vehicular Tunnel, which was named in his honor.

**HOLLAND, HENRY RICHARD VASSALL FOX**, 3rd BARON, 1773–1840, English statesman, was a nephew of CHARLES JAMES FOX, under whose influence he became a leader of the Whig faction in the House of Lords, opposing the regency proposals and supporting much progressive legislation. In 1806 he negotiated a treaty with the United States through the American plenipotentiaries, Monroe and Pinckney. He was lord privy seal (1806–7) and, on the return of the Whigs to power (1830), became chancellor of the duchy of Lancaster. In 1796 he began the restoration of Holland House, where he assembled a brilliant salon of statesmen and men of letters. He



published translations from Spanish and Italian writers, satires on the Irish Union movement, and *Memoirs of the Whig Party During My Time* (1852).

**HOLLAND, JOHN PHILIP**, 1840–1914, American inventor, was born in Liscanor, Ireland. After coming to the United States in 1873 he taught school in Paterson, N.J., and experimented with the design of a submarine. The 31-foot-long *Fenian Ram*, which he launched in 1881 on the Hudson River, embodied the principal features of the modern submarine. In 1898 he achieved great success with the 53-foot-long *Holland* which had a gasoline engine for surface propulsion and an electric motor for submerged cruising. After 1900 the Holland Torpedo Boat Company built submarines for the American, British, Russian, and Japanese navies. See *SUBMARINE*.

**HOLLAND, THOMAS ERSKINE**, 1835–1926, British international lawyer. He was educated at Oxford University and in 1874 he was appointed to the Vinerian readership of English law, and subsequently to the international law professorship. Besides editing the *Institutes of Justinian* (1873), his publications include *Elements of Jurisprudence* (1880); *Studies in International Law* (1898); *Neutral Duties in a Maritime War* (1905); *The Laws of War on Land* (1908); *Letters to the Times on War and Neutrality* (1881–1920).

**HOLLAND**. See *NETHERLANDS, THE*.

**HOLLAND**, city and summer resort, SW Michigan, in Ottawa County; at the mouth of the Black River on Lake Macatawa, an arm of Lake Michigan; on the Pere Marquette Railroad and U.S. Highway 31; about 25 miles SW of Grand Rapids. Holland was founded in 1847 by a company of secessionists from Holland's Dutch State church, who were led by Rev. A. C. Van Raalte. The city's population is still predominantly of Dutch descent. Holland is the seat of Hope College and the Western Theological Seminary. A Tulip Festival is held here each May. The chief products include furniture, shoes, Dutch novelties, lumber, and leather. Pop. (1950) 15,858.

**HOLLAND, NORTH and SOUTH**. See *NORTH HOLLAND*; *SOUTH HOLLAND*.

**HOLLAND TUNNEL**. See *NEW YORK, city*.

**HOLLANDIA**, seaport and district headquarters, Netherlands New Guinea, on the N coast, 20 miles W of the border of British Northeast New Guinea. Hollandia's position on Humboldt Bay provides a protected harbor, with depth sufficient to accommodate vessels of deep draft. It is the last port on the eastward stretch of the 3,000 miles of the Netherlands-Indonesian islands. Although the area has been little developed, Hollandia has a mission, a post office, and a trading station. Before trade was restricted by World War II, Hollandia exported bird of paradise skins. The population consists of a few hundred natives and a few whites.

The Japanese took the port early in World War II and made it into an important air and supply base. United States troops landed on Apr. 22, 1944, and a United States supply and naval base was established. The naval base was purchased by the Netherlands after the war.

**HOLLANDS**. See *GIN*.

#### World War II damage to the village of Hollandia

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**HOLLAR, WENCESLAUS**, 1607–77, Bohemian etcher, was brought to England (1637) by the Earl of Arundel, and in 1640 was appointed drawing-master to the Prince of Wales. At the same time he published *Ornamentus Muliebris Anglicanus*, 28 plates of the dresses of Englishwomen, followed in 1642–44 by the dresses of women in other European countries. During the civil war he was forced to fly from England (1645), but returned in 1652, and died in poverty at Westminster. He left etchings from Holbein, Paolo Veronese, Titian, Van Dyck.

**HOLLEY, ALEXANDER LYMAN**, 1832–82, American metallurgist, was born in Lakeville, Conn., and educated at Brown University. With Zerah Colburn he published *The Permanent Way and Coal-Burning Locomotives of European Railways* (1858), which called attention to the extravagance of the American as compared with the English railroads. In 1863 he bought in England for an American firm the American rights to the Bessemer steel process and in 1865 he established at Troy the first Bessemer plant in the United States. Afterwards he designed similar plants for Pittsburgh, St. Louis, Joliet, Ill., and other places, and shared in the subsequent development of this process, taking out several patents for improvements. He wrote *American and European Railway Practice* (1860) and *A Treatise on Ordnance and Armor* (1865). In 1921 the American Society of Mechanical Engineers established the Holley medal in his honor.

**HOLLEY, MARIETTA**, 1850–1926, American humorous writer, was born in Ellisburg, N.Y., and passed most of her life in that vicinity. She wrote *My Opinions and Betsy Bobbett's* (1873); *Samantha at the Centennial* (1877); *Samantha at Saratoga* (1887); *Samantha Amongst the Brethren* (1890); *Samantha Amongst the Colored Folks* (1892); *Samantha at the World's Fair with Josiah Allen's Wife* (1899); *Samantha on Women's Rights* (1913); and *Josiah Allen on Women's Rights* (1914).

**HOLLIDAYS COVE**, former city, West Virginia, in Brooke and Hancock counties, immediately southwest of Weirton. It was a residential city inhabited by workers in the steel mills at Weirton; in 1947 it was merged with Weirton when the latter was incorporated as a city. Hollidays Cove grew up about a blockhouse built here in 1776 by John Holliday.

**HOLLIDAYSBURG**, borough, S Pennsylvania, county seat of Blair County, on the Juanita River, the Pennsylvania Railroad, and U.S. highways 22 and 220, about eight miles S of Altoona. It was settled in 1768 by Adam and William Holliday, Irish immigrants. The borough was the connecting link of the Pennsylvania Canal and the Portage Railroad in the 1830's. Hollidaysburg is located in a region abounding in coal, iron ore, limestone, and ganister quarries. It has railroad and machine shops, and manufactures boilers. Pop. (1950) 6,483.

**HOLLINGWORTH, LETA SETTER**, 1886–1939, American psychologist, was born in Chadron, Neb., and studied at Nebraska and Columbia universities. She was on the faculty of Teachers College of Columbia (1919–39). She was noted for studies of gifted children in which she found them somewhat healthier and better adjusted than the average child. She was also instrumental in the classification of mental defectives into moron, imbecile, and idiot levels on the basis of I.Q., and wrote: *The Psychology of Sub-normal Children* (1920); *Gifted Children* (1926); *Psychology of the Adolescent* (1928).

**HOLLINS COLLEGE**. See *COLLEGES*.

**HOLLOWAY, EMORY**, 1885– , American author and educator, was born in Marshall, Mo., and studied at Hendrix College and the University of Texas. He taught English at Adelphi College from 1914 until 1937, when he became professor of English at Queen's College, North Carolina. Specializing in the study of WALT WHITMAN, he compiled and edited a definitive edition of the poet's works, and published a distinguished biography, *Whitman—An Interpretation in Narrative* (1926; Pulitzer prize).

many buildings of the pre-Civil War period. The city is the seat of Rust College, founded in 1868 by the Methodist church. Holly Springs is a farm market center, a shipping point for cotton, and manufactures clay products. Pop.(1950) 3,276.

**HOLLYHOCK**, a popular garden plant belonging to the Mallow family, *Malvaceae*. Hollyhock, *Althaea rosea*, a native of China, is one of the oldest cultivated flowers. It is a short-lived perennial plant that develops large, hairy, lobed leaves and a simple, wandlike hairy stem which often grows to a height of 10 feet. The large open flowers, which blossom during summer, are either single or double and have large spreading petals ranging in color through white, rose, red, and yellow. The plant often behaves essentially as a biennial, sometimes dying after flowering as a result of frost damage or exposure of the crown of the root system.

Hollyhocks require rich, well-drained soil and grow best in full sunlight. To prevent injuries from frost exposure, the crown of the plant is placed below the surface of the ground. Their most common enemy, the hollyhock rust, *Puccinia malvacearum*, is best controlled by spraying infected plants with Bordeaux mixture. When the plants are grown outdoors in well-drained, deeply dug soil, proper setting of the crown below the surface and correct placing of the taproot in the soil will do much to prevent development of rust.

J. A. STEYERMARK

BIBLIOG.—L. H. Bailey, *Standard Encyclopedia of Horticulture* (1939).

**HOLLYWOOD**, famous center of the United States motion picture industry, California, since 1910 a part of LOS ANGELES.

**HOLLYWOOD**, city, Florida, Broward County, on the Atlantic Ocean and the Inland Waterway, the Florida East Coast and the Seaboard Air Line railroads, and U.S. Highway 1, about 18 miles N of Miami. Founded by California promoters during the real estate boom of the 1920's, the city was completely platted before its site on swampland and marshes was filled in. The city's extensive tourist accommodations and recreation features have made it a popular winter resort. Canneries and fruit-packing plants are the chief industries. Pop. (1950) 14,351.

**HOLMES, MARY JANE**, 1825–1907, American novelist, was born in Brookfield, Mass. She was the author of 39 sentimental novels, the most popular of which was *Lena Rivers* (1856). The aggregate sales of her novels amounted to more than two million copies.

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**HOLMES, OLIVER WENDELL**, 1809–94, American physician and man of letters, was the fourth child and elder son of the Rev. Abiel Holmes, minister of the First Church of Cambridge before it became Unitarian. His mother, Sarah, daughter of Oliver Wendell, was ultimately of Dutch descent, though connected also with the Boston families of Jackson and Quincy. Most of the boy's early memories were associated with the "old Gambrel-roofed house" in Cambridge where he was born. At Phillips Academy, Andover, then a stronghold of Congregational orthodoxy, young Holmes was prepared to enter Harvard College with the class of 1829, which he was later to make famous by poems written for successive class reunions. He spent a year studying law before settling on medicine as his life work.

**Early Verse.** While he was still hesitating over the choice of a profession, he exercised a ready pen in the writing of light verse. The three stanzas entitled "Old Ironsides" (1830), which he tossed off in protest against the proposed demolition of the famous frigate *Constitution*, went the rounds of the newspaper press and caused a furore that resulted in the permanent preservation of the historic vessel. This and other early pieces such as "The Last Leaf" and "My Aunt" were included in *Poems* (1836), a volume which became the germ of later collections. Two familiar



J. H. MCFARLAND, U.S. FOREST SERV.

**American Holly Tree, *Ilex opaca***, above, is an evergreen. Leaves and fruit of holly, left

**HOLLY**, a genus of spiny trees or shrubs belonging to the family *Aquifoliaceae*. Holly trees often grow to a height of 20 to 35 feet and have glossy leaves and bright red fruits. They form a characteristic part of the flora of the Ohio and Mississippi river valleys. There are 275 species of holly distributed throughout North and South America, Asia, Africa, Australia, and Europe. Two popular evergreen species, *Ilex glabra* and *I. opaca*, are both common in cold northern regions while *I. cornuta*, and *I. Pernyi* are hardy but need protection from frost. *I. aquifolium*, a favorite English garden species, and *I. opaca*, a common North American plant, have masses of bright berries and glossy leaves used for decoration. Two deciduous species, *I. laevigata* and *I. verticillata* also have beautiful fruits that are used at Christmas time.

Most hollies are desirable hedge plants for they survive severe pruning and may be clipped into any desired shape. They are grown on rich, well-drained soils in shaded places, many species growing in moist areas or swamps. They usually reproduce by seeds although evergreen species are frequently propagated by growing cuttings of ripe wood under glass or by grafting them onto seedlings. Holly leaves and fruits are extensively used in bouquets and wreaths at Christmas time, and the tough, white, holly wood is used in the manufacture of brushes, woodenware, and dental supplies. The leaves of two tropical species, *I. paraguariensis* and *I. conocarpa* yield Paraguay tea, a beverage popular in South America while *I. vomitoria* yields an exhilarating beverage, *Cassine*, made from the leaves. Some species of holly yield useful medicinal supplies. See MATÉ.

J. P. C.

**HOLLY SPRINGS**, city, N central Mississippi, county seat of Marshall County; on the Illinois Central and the Frisco railroads, and U.S. Highway 78, about 45 miles SE of Memphis, Tenn. The springs, known as Susvatooky, were used by the Indians before the Chickasaw nation ceded its lands to the U.S. government in 1832. William Randolph of Virginia founded the city in 1835; it was incorporated in 1837 and grew rapidly after the arrival of the railroad in 1838. During the Civil War, Holly Springs was raided 61 times and served as General Grant's base of supplies until captured by Confederate General Van Dorn in 1862. His victory is said to have delayed for a full year the fall of Vicksburg. Holly Springs, built about a courthouse square, has



**Oliver Wendell Holmes**, who won fame as a physician and man of letters, pictured at the age of 41. In the background are his birthplace in Cambridge, medical students at Harvard, where he studied and taught, and his study in Boston, where he wrote

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essays contributed to the *New England Magazine* (1831–32) bore the title "The Autocrat of the Breakfast Table" which was to be revived to memorable effect after an interval of 25 years. During that period Holmes was too deeply absorbed in his profession to devote much time to literature.

**Physician and Professor.** After taking courses at Harvard to supplement his private study of medicine with a Boston doctor, Holmes spent two further years of training in the hospitals of Paris. He also found time to travel on the Continent and to visit England before setting up his practice in Boston. Success in his profession was slow in coming. His brisk manner and unflinching wit did not recommend him to patients who expected in a physician a certain gravity of demeanor. Holmes joyfully acknowledged the "recognition" afforded him in 1838 by the offer of a professorship of anatomy at Dartmouth College. This post, which required his absence from Boston for only three months of the year, he held until 1840. He was then called to a similar chair—or as he loved to call it, a "settee"—at Harvard, where he remained in active service until 1882. His lectures in anatomy were always given at the end of the heavy morning program because he was the only member of the faculty who could rouse and hold the flagging interest of the students at that hour. Aside from his classroom duties Holmes took an active part in forming the American Medical Association. His technical publications include pamphlets on *Homeopathy and Its Kindred Delusions* (1842) and on *The Contagiousness of Puerperal Fever* (1843). This last is an admirable piece of scholarship and reveals Holmes's acuteness in drawing from the assembled evidence conclusions which were far in advance of the science of his day. His minor papers on medicine were collected as *Medical Essays* (1883). It should always be remembered that Holmes was first and foremost a physician and a teacher of medicine, who gave to literature only what time he could spare from the demands of an exacting calling.

**A Boston Brahmin.** During the years when he was engaged in establishing himself as a doctor, Holmes was becoming also a Boston celebrity. His small dapper figure was always in evidence at dinners and other public events, where he was frequently invited to speak or to read a poem composed for the occasion. From conventions sponsored by reformers, however, he was conspicuously absent. Except for his rejection of Calvinism, he held conservative opinions on most topics of the day. The only political question that moved him deeply was the attempted secession of the Southern states, which prompted "Brother Jonathan's Lament for Sister Caroline" and, as the war grew more bitter, other expressions of fiery patriotism. Holmes, however, had little taste for controversial writing. As a sparkling conversationalist, perhaps a trifle too much given to monologue, he was equaled only by James Russell Lowell. The best of Lowell came out in intimate fireside chats, while Holmes excelled in talk stimulated by good dinners and good company. Though prevented by asthma from making long journeys, he gave many lyceum lectures in towns near Boston, the city which in his eyes at least was

truly "the hub of the Universe." His marriage in 1840 to Amelia Lee Jackson, daughter of a justice of the Massachusetts Supreme Court, confirmed his identification with the local elite to whom he jokingly applied the name of the "Brahmin caste of New England." The eldest of the three children of this marriage, OLIVER WENDELL HOLMES, became the noted jurist of a later day.

**The Autocrat of the Breakfast Table.** In 1857, when the *Atlantic Monthly*—so named by Holmes—was founded with Lowell as its editor, Holmes was at once drafted into service as a leading contributor. The revived "Autocrat of the Breakfast Table" papers which appeared in each successive number proved to be the most generally popular feature of the new magazine and had much to do with bringing it through the financial depression that marked the winter of its birth. They were published in book form in 1858, and were followed by three similar series of light essays, none of which quite maintained the sparkle of the first. In these brilliantly desultory causeries, touching many things and exhausting nothing, least of all the reader, Holmes discovered an appropriate vehicle for his conversational genius. He also included with the prose some of the best of his verses, such as "The Deacon's Masterpiece; or, the Wonderful 'One-Hoss Shay,'" an amusing parable glancing at the decline of Calvinism, and "The Chambered Nautilus." At the *Atlantic* dinners, and at the meetings of the Saturday Club which was organized about this time, Holmes was in his element. His mind was lively and wide-ranging, and his witty sallies were repeated everywhere. On all kinds of subjects, from poetry to horse racing and boxing, he was an acknowledged oracle. For the inner core of Puritan mysticism Holmes had little sympathy. He felt only a settled dislike for Jonathan Edwards, and though he wrote a life of Emerson for a popular series, he hardly comprehended the nature of Transcendentalism.

In his later years Holmes made a brief second visit to Europe. At the time of his death he had outlived the other New England writers of his generation, all of whom had attained to a venerable old age. Like Bryant, Emerson, Longfellow, Whittier, and Lowell, he was beloved and revered by his contemporaries. Perhaps no American author since Holmes has won a comparable tribute of affection, but with time his literary reputation has declined. He is now remembered as a Beacon Street wit and a skillful writer of *vers de société* who maintained through the romantic era of American literature the rational outlook of the previous century and who combined with sanity and balance a lightness of touch that was his own peculiar gift.

GEORGE FRISBIE WHICHER

**Contributions to Medicine and Psychiatry.** Oliver Wendell Holmes must be regarded as a physician who wrote, rather than an author who was professor of anatomy and physiology at Harvard. The medical discovery for which he is most noted was presented by him in 1843 in a lecture entitled, "The Contagiousness of Puerperal Fever." Holmes' assertions were violently attacked but he defended them vigorously and especially emphasized the importance

of cleanliness (asepsis) in obstetrical practice for doctors, nurses, and midwives. In 1847 SEMMELWEISS in Austria independently corroborated Holmes' findings.

When WILLIAM T. MORTON, a dentist, introduced sulfuric-ether under the name of letheon to abolish sensation during a surgical operation in Boston in 1846, Holmes suggested that the procedure be called anesthesia and the drugs producing it anesthetics. While Holmes' medical discoveries were few, during his long term as dean of the medical faculty at Harvard he exercised a powerful influence in the support of progressive medical ideas. Among these may be mentioned the establishment of a department of dentistry in the Harvard Medical School—the first of its kind in an important university in America—his relentless fight against homeopathy on the one hand and over-medication on the other, and his insistence that the discoveries of the growing sciences of physics, chemistry, and biology be incorporated into medical theory.

Throughout his career, one of his main efforts was to combat the depressing implications of Calvinist theology. To this end he published two important essays, "The Mechanism in Thought and Morals" and "Crime and Automatism." In the first of these he described many of the mechanisms, including dreams and the unconscious, subsequently embodied by SIGMUND FREUD in the structure of psychoanalysis, and in the second, advocated treatment of criminals instead of their punishment. Realizing that many of his ideas concerning mental illness and criminology would have found cold reception among his medical colleagues, Holmes wrote three so-called "medicated" novels, *Elsie Venner* (1861), *Guardian Angel* (1867), and *The Moral Antipathy* (1891). In each of these he demonstrated insight into psychiatric conditions which corresponds closely to present conceptions. His writings on medicine and related fields include *Medical Essays, 1842-1882* (1883) and *Pages from an Old Volume of Life* (1892).

C. P. OBERNDORF

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**HOLMES, OLIVER WENDELL**, 1841-1935, American jurist, was born in Boston, Mass., the son of OLIVER WENDELL HOLMES. He graduated from Harvard (1861), served three years with the 20th Massachusetts Regiment in the Civil War, and was mustered out a captain (1864) after being wounded three times. He graduated from Harvard Law School (1866), was admitted to the bar, began to practice in Boston, and later was with the firm which became Shattuck, Holmes, and Munroe. Editor of the *American Law Review* (1870-73), he also edited the 12th edition of Kent's *Commentaries on American Law* (1873), since recognized as the standard text. His *The Common Law* (1881) was a fine contribution to legal science, its ideas becoming part of common juristic thought. Harvard offered him a chair in its law school, which he assumed in January, 1882, and resigned when Governor Long appointed him to the Supreme Court of Massachusetts (December, 1882).

Holmes became the state chief justice (1899), and in 1902 President Theodore Roosevelt appointed him associate justice of the U.S. Supreme Court. He was aware of the limited validity of legal principles, shaped as they are by circumstance, and he believed that the forming of future law is the concern of the legislative branch of government. His interpretation of the law

was concerned with justice to both sides, even though his personal convictions were often against the legislation before him and even though he lacked faith in the ultimate rightness of answers to society's problems. No legal principle was too respectable, no formula too absolute, to escape his skeptical consideration. After 30 years of distinguished service on the Supreme Court bench, he retired (1932). See SUPREME COURT OF THE UNITED STATES.

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**HOLMES, WILLIAM HENRY**, 1846-1933, American artist, geologist, and archaeologist, was born near Cadiz, Ohio. After studying art under Theodore Kauffman, he was employed by the Smithsonian Institution as a staff artist, and in 1872 became artist to the U.S. Survey of the Rocky Mountain region. In 1874 he was appointed assistant geologist in the government survey of Colorado, and in 1875 headed a party surveying the San Juan Valley, where he became interested in cliff-dwelling archaeology. In 1880, following a year of European art study, he joined the staff of the U.S. Geological Survey and explored the Grand Canyon. He studied Indian ruins in New Mexico and Arizona in 1886. As archaeologist in the American Bureau of Ethnology (1889-94), he made the valuable discovery that American stone implements were post-Paleolithic in origin. He became curator of anthropology at the Field Museum of Chicago (1894-97), head curator of anthropology in the Smithsonian Institution (1897-20), chief of the American Bureau of Ethnology (1902-09), and director of the National Gallery of Art (1920-32). A gifted scientific artist, Holmes contributed greatly to enlivening the appearance of museum exhibits.

**HOLMIUM** is a metallic ELEMENT which was discovered by Soret in 1878. It belongs to the rare-earth group of metals and occurs with other members of the group in gadolinite, samarskite, and other minerals. The symbol for holmium is Ho. It has an atomic weight of 163.5 and its atomic number is 67. Holmium has a valence of +3. It forms a grayish-white oxide,  $\text{Ho}_2\text{O}_3$ , which reacts with many acids to form orange-yellow salts.

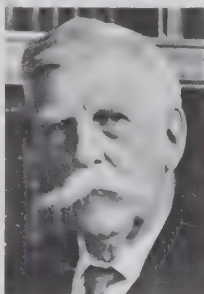
**HOLOCAINE**, or phenacaine, one of the first local anesthetics. Because it is toxic when injected, its use is restricted to surface application.

**HOLOCENE**. See RECENT.

**HOLOGRAPHIC WILL**. See WILL.

**HOLOTHURIAN**, popularly called "sea cucumber," a marine animal belonging to the phylum ECHINODERMATA and the class Holothuroidea. The body is soft, muscular, and cucumber-shaped, with the mouth surrounded by tentacles at one end and the anus at the other. The body wall contains small ossicles and presents usually five rows of tube feet. Holothurians have a unique way of protecting themselves: when attacked, they eject their viscera and entrap the enemy in the sticky mass. The viscera is subsequently regenerated. As an article of food, holothurians (called *trepangs*) are used by the Chinese in making soup.

**HOLST, GUSTAV**, full name **Gustave Theodore von Holst**, 1874-1934, English composer, was born in Cheltenham of Swedish ancestry. His father, an organist and pianist, tried to direct his son toward a career as a concert pianist, but the boy's early interest in composition and a tendency toward neuritis while still a student at the Royal College of Music in London turned him definitely from that aim. As a student of Sir Charles Villiers Stanford, he won a scholarship for composition in 1895, and he also took up the study of the trombone, on which he became proficient enough to play professionally. His several years of service as first trombone of the Carl Rosa



Justice Holmes

ACME



Opera Company and later in trombone sections of the Scottish and other symphonic orchestras explains his unusually effective scoring for brass.

In 1904 Holst turned from playing to a career as teacher at various schools, including Morley College, St. Paul's Girls' School, and the Royal College of Music. His early compositions, written at the turn of the century, were rather experimental. The first public performance of any of his orchestral work took place in 1904 when his *Ballet Suite* was played under his own direction at the Royal College of Music.

About 1906 Holst became interested in Sanskrit, and his compositions of this period, including several operas and the orchestral suite *Beni Mora*, reflect this interest. His best known work, *The Planets*, a suite for orchestra, was composed in 1915-16. Here he attained the full maturity of his style which, daring as it was for its day, was of a clarity which made his meaning always plain and enjoyable.

Holst left England in 1918 for travels to Algeria, Constantinople, and Asia Minor. On his return he plunged again into teaching, composing, and conducting which led in 1923 to a serious breakdown. From then on he lived very quietly, devoting his energies exclusively to composition.

One of Holst's most delightful compositions is his *St. Paul's Suite* for strings, written for performance at the school where he taught so long. Here again the lucidity of his writing makes the contrapuntal combining of themes a joy to hear. His early *Somerset Rhapsody* makes similar contrapuntal use of English folk tunes. He also wrote a great deal of choral music, including his *Hymn of Jesus*, *Ode to Death*, and a *Choral Symphony* on passages from Keats. His best known operas are *The Perfect Fool* and *At the Boar's Head*.

IRWIN FISCHER

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**HOLST, HERMANN EDUARD VON**, 1841-1904, German-American historian, was born in Felin, Russia, of German parentage. He received his doctor's degree in history at Heidelberg (1865), traveled in France and Italy, and came to the United States (1867), where he made an extensive study of American institutions. He returned to Europe (1872), taught at the universities of Strasbourg and Freiburg, and in 1892 accepted a teaching appointment at the University of Chicago. Influenced by German historiography, by his interest in the integration of Germany, and his hatred of autocracy and slavery, von Holst's most important work was *The Constitutional and Political History of the United States* (1873). Originally written in German and later translated into English, it is a heavily documented treatise championing the Union and antislavery cause. This viewpoint dominated his other works which include *John Calhoun* (1882), *John Brown* (1888), and *The French Revolution Tested by Mirabeau's Career* (1894).

**HOLSTEIN**. See SCHLESWIG-HOLSTEIN.

**HOLSTEIN, FRIEDRICH AUGUST KARL FERDINAND VON**, 1837-1909, German foreign office official, was born in Schwedt an der Oder, in Prussia, studied in Berlin, and entered the diplomatic service in 1859. His first important post was in Paris where he served under the German ambassador Count HARRY VON ARNIM and was witness for Bismarck against Arnim in the case which caused Arnim's dismissal and exile. Von Holstein returned to Berlin and served in the foreign office (1878-1906). Although he never attained rank higher than that of *vortragender Rat* (speaking counselor) he was a powerful behind-the-scenes figure, virtually guiding German foreign policy during a critical period. From 1890 to 1906 Holstein did everything possible to prevent the return of Bismarck, and resigned after the Morocco Crisis (1906).

**HOLSTEIN CATTLE**. See CATTLE.

**HOLSTON RIVER**, is formed near Kingsport, NE Tennessee, by the North and South Forks, which

rise in Smyth County, SW Virginia. The Holston River flows southwesterly about 115 miles until it unites with the French Broad to form the TENNESSEE RIVER just above Knoxville.

**HOLT, HENRY**, 1840-1926, American publisher and author, was born in Baltimore, Md. He was graduated from Yale in 1862 and from the Columbia Law School in 1864. In 1863 he entered the publishing business with G. P. Putnam, and in 1873 became president of the firm of Henry Holt and Company, New York. He was a fellow of the American Association for the Advancement of Political Science. He published *Calmire*, *Man and Nature* (1892); *Talks on Civics* (1901); *Sturmsee*, *Man and Man* (1905); *On the Civic Relations* (1907); *The Cosmic Relations and Immortality* (1919). He edited the *Unpopular Review* and the *Unpartizan Review*.

**HOLT, JOSEPH**, 1807-94, American jurist, was born in Breckinridge County, Kentucky, and began to practice law in 1828. In 1857 he was appointed commissioner of patents, was made postmaster general two years later, and in 1861 became secretary of war. Lincoln made him judge advocate of the army, and before he retired, in 1875, he was brevetted major general. The courts before which Fitz-John Porter and Lincoln's assassins were tried are among those over which he presided.

**HOLT, LUTHER EMMETT**, 1855-1924, American pediatrician, was born in Webster, N.Y. He was educated at the University of Rochester and at the New York College of Physicians and Surgeons. As consultant and director of various children's hospitals and clinics he developed original methods for the treatment of children's diseases and established pediatrics as a special science. His widely read pamphlet, *The Care and Feeding of Children* (1894), and *The Diseases of Infancy and Childhood* (1896), a standard textbook, were a considerable influence in lowering the infant mortality rate and generally improving the health of American children.

**HOLY ALLIANCE**, a league formed by the sovereigns of Russia, Austria, and Prussia with the declared intention that they would be guided both in their internal administration and in their foreign policy by the lofty principles of Christianity. The document was drawn up by ALEXANDER I of Russia, and signed at Paris on Sept. 26, 1815. Alexander was probably the only sovereign who signed it with any real conviction, though it was later acceded to by the other European sovereigns. Great Britain, while commending the document never signed it. France repudiated it, England refused to give it any support, and by 1825 it had ceased to be of importance. An attempt to extend its influence to America brought about the famous MONROE DOCTRINE. See VIENNA, CONGRESS OF.

**HOLY COMMUNION**. See EUCHARIST.

**HOLY CROSS, COLLEGE OF THE**. See COLLEGES.

**HOLY CROSS, MOUNT OF THE**, in Sawatch Mountains, W central Colorado, 18 miles NW of Leadville, 13,996 feet elevation. The Holy Cross National Monument was created in 1929 because of the huge cross formed by two snow-filled ravines. Later, the cross almost disappeared, and the monument was abandoned in 1950.

**HOLY DAYS**, religious feasts celebrated in honor of the Blessed Trinity, in commemoration of the life of Christ, and in honor of the Virgin Mary and the saints. In the Roman Catholic church such feasts are either purely liturgical, in which special prayers and ceremonies are added to the Divine Office and the Mass, or they are also holy days of obligation. The Church year is divided into two concurrent types of feasts. The Temporal Cycle (cycle of time) celebrates particularly the life of Christ. The Sanctoral Cycle honors the Virgin Mary, St. Joseph, and other saints with feasts of varying solemnity. The Temporal Cycle has two main divisions: that pertaining to the Incarnation of Christ (Christmas,

Epiphany) and that pertaining to his Redemption (Lent, Passiontide, Easter, Ascension Thursday, Pentecost, and the following Sundays).

ROBERT F. HARVANEK

**HOLY DAYS OF OBLIGATION**, in the Roman Catholic church, feasts other than Sundays with the obligation to attend Mass and to refrain as much as possible from servile work. The holy days of obligation prescribed in the United States are Christmas, the Circumcision of Jesus (January 1), Ascension Thursday (40 days after Easter), the Assumption of the Virgin Mary (August 15), All Saints (November 1), and the Immaculate Conception of the Virgin Mary (December 8).

DENNIS E. SCHMITT

**HOLY GHOST**. See **HOLY SPIRIT**.

**HOLY GRAIL, THE**. See **GRAIL, HOLY**.

**HOLY ISLAND**, or **Lindisfarne**, an island in the North Sea, off the E coast of Northumberland County, England, just N of Belford; nine miles SE of Berwick; area 1.6 sq. mi.; pop. (1931) 287. Holy Island is connected with the mainland by a low isthmus, which is covered at high tide. Of interest are the village and the ruins of a priory church founded in 1094; St. Mary's Church, built in 1130; and the 16th-century castle. The ruins of a monastery, founded by St. Aidan in 635, are preserved; it is believed to be the first establishment of Celtic Christianity in England and is associated with St. Cuthbert. Destroyed by the Danes in 793, the monastery was rebuilt. The monks fled before the Danes again in 883, and the island was not again occupied until the establishment of a Benedictine monastery on Holy Island in 1093.

**HOLY LAND**. See **PALESTINE**.

**HOLY LEAGUE**, an alliance formed by Pope Julius II in 1511 with Venice, Switzerland, Spain, the Holy Roman Empire, and England in order to expel the French under Louis XII from Italy. In retaliation Louis threatened to depose the pope, and he compelled the French bishops to renounce their allegiance to him. The fighting was inconclusive, but after the death of Julius in 1513 the unfavorable political situation forced the French to abandon Italy.

R. W. QUINN

**HOLY ROMAN EMPIRE, THE**, 962–1806, practically the eastern part of the empire of which Charles the Great was crowned emperor at Rome A.D. 800. However, the name Holy Roman Empire (officially styled in the Latin wording *Sacrum Imperium Romanum Nationis Germanicae*) did not come into use until the German king Otto I (The Great) was crowned as

Roman emperor in 962. The ancient Roman Empire, founded by the great conquests of the republic and maintained and cemented by the personal rule of Augustus and his successors, was broken to pieces in the fifth century by the successive inroads of the GERMANIC TRIBES. These Germanic conquests, after a long period of turmoil, resulted in the foundation of the modern European states, whose separate independence is the negation of the idea of universal rule which was the underlying principle of the empire under the Caesars. The year A.D. 476, when the last emperor, Romulus Augustulus, was deposed by the barbarian Odoacer, has been accepted as marking the extinction of the Roman Empire, at any rate in western Europe.

**The Twilight of the Old Empire and Dawn of the New**. It is certain that contemporaries did not consider that the Roman Empire had perished in the fifth century, and did not attribute any very special importance to the events of the year 476. For about a century there had been an administrative subdivision between east and west, one emperor residing in Italy and the other in Constantinople. The abdication of Romulus Augustulus was, in a formal sense, the termination of this arrangement and the restoration of unity. The news was sent to Emperor Zeno in Constantinople, from whom Odoacer received his titles to rule in Italy, and whose image was imprinted on the coins of the whole empire. The barbarian invaders were so impressed and fascinated by the great tradition of the empire that they accepted it while they were destroying its power. They regarded it as part of the fundamental nature of things, as something that always had existed and always would exist. Thus the emperor in Constantinople became, after 476, the sole head of a united empire, whose distant sovereignty was undisputed, though its actual exercise was impossible in the western provinces.

This state of things lasted for nearly three centuries, and might have gone on until the empty form became so unreal and obsolete that it gradually decayed away. But this process of slow decay was interrupted by two events—the growing power of the papacy, and the invasion of Italy by another heathen and barbarous people of German origin, the Lombards. The bishops of Rome, freed from efficient secular control by the absence of the emperors from Italian soil, began, from GREGORY THE GREAT (590–604) onward, to claim, not merely spiritual independence and domination, but also temporal rule over a large part of central

Italy. Upon the papacy fell the main burden of resisting Lombard encroachments during the seventh and eighth centuries. From Constantinople little efficient aid was received after the temporary successes of the generals of Justinian. The consequent alienation of Italy from its nominal rulers was increased when Leo the Isaurian and his successors sought to purify Christianity by prohibiting the worship of images. The consequent iconoclastic controversy resulted in open defiance of imperial authority by the Italian clergy. But the popes had too little military strength to withstand the Lombard rulers without external assistance. Estranged from the East, they sought succor from the great western power which was being built up by the Franks. Gregory III appealed to Charles



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"The Coronation of Charlemagne," from painting by F. Kaulbach



Martel, and offered him the titles of consul and patrician. Pippin, who established the Carolings on the Frankish throne, twice led an army into Italy for the defense of the church; and the alliance of the Frankish dynasty with the bishop of Rome was finally cemented in 800, when LEO III, repudiating the claim of the Empress Irene, who had deposed and mutilated her son, to fill the throne of the Caesars, placed the imperial crown on the brow of Charles the Great. Thus Italy passed under the rule of a German king, whose vast dominions seemed likely to be continuous with western Europe and Latin Christianity. See CHARLEMAGNE.

**Disintegration of Charlemagne's Empire.** But the great Frankish power which Charles the Great and his predecessors had built up did not prove sufficiently lasting to be the foundation on which the traditions of the Roman Empire could securely rest. Out of the permutations and combinations of territory among his successors three main subdivisions gradually emerged. Western Francia became in time the historic kingdom of France; Eastern Francia became Alemannia, or Germany; while between them was a more shadowy middle kingdom, originally Lotharingia, but ultimately splitting up into a number of separate states, of which part was the kingdom of Burgundy, or Arles, while another part was Italy, though the latter name only concealed a further process of disintegration into innumerable petty subdivisions. During the stormy and confused period of subdivision the idea of the Roman Empire in the West came very near to extinction. Even the papacy, which represented the tradition of Roman unity on its ecclesiastical side, sank to the very nadir of its authority and prestige.

**Emergence of German Power.** Amidst the general anarchy, which seemed likely to make western Europe the prey of the Norsemen, the Magyars, and the Slavs, the first movement of reorganization came from Germany. Henry the Fowler (919-936), duke of the Saxons, formed a fairly coherent state by combining the German duchies to resist the barbarian invasions. His son and successor, Otto the Great (936-973), continued his policy, and raised the German monarchy to a commanding place in Europe. To cement his power, he desired to gain the support of the church, and to strengthen the church he must reform the papacy and revive its influence. These interests brought him into Italy. In 951 he assumed the crown of Italy in the old Lombard capital, Pavia, and in 962 he was crowned emperor by Pope John XII. The assumption of the title by a really powerful king marks a restoration of the imperial tradition to something like its old importance.

Otto the Great did not rule such vast dominions as had owned the sway of Charles the Great, but his coronation is in some ways a more memorable event than that of his famous predecessor. From this time the union of the German and Italian crowns was continuous, and this union is the basis of what is historically known as the Holy Roman Empire. The epithet "Holy" marks the intimate connection with the papacy, which had played such a prominent part in separating east and west, and in maintaining in Latin Christendom the conception of unity under a single authority. It was the papacy which had first given the imperial title to a German ruler in 800, and it was the papacy which again restored the title to the German kings in 962. Whoever was accepted as king in Germany was regarded as potential emperor, but he did not, at any rate in the Middle Ages, assume the full dignity of *Imperator Augustus* until he had been crowned by the pope.

Of the two great subdivisions of Charles the Great's dominions the ascendancy of the eastern kingdom seemed assured in the 10th century. One fragment of the middle kingdom—Italy—was annexed by Otto I; another, the kingdom of Arles or Burgundy, fell in 1032 to one of his successors, Conrad II. There were

now four crowns in the possession of the western emperors—that of Germany, assumed after election at Aachen; that of Italy, which Otto wore at Pavia, but was received by his successors at Monza or Milan; that of Burgundy, imposed at Arles; and, finally, the imperial crown, conferred in solemn ceremony by the pope at Rome. Until this last coronation took place, the highest title of the German king was king of the Romans.

**The Empire's Weakness.** From the first there was something unreal about the Holy Roman Empire, and as time went on it became more and more a shadowy anachronism. In medieval theory Christendom was a single state under the secular headship of the emperor and the spiritual headship of the pope. They were the two viceregents of the Deity. But the claim of a secular prince to universal lordship was of very little practical value. The separate states—such as France, England, Castile, and Aragon—went their own way without any idea of acknowledging external authority. The very fact that the imperial dignity was bound up with territorial rule in Germany was in itself a reason for rejecting its pretensions. In theory any prince could aspire to the office of emperor; and we find French kings, Spanish kings, English princes, among the candidates on several occasions. But the fact that the choice rested with the German princes or electors rendered it almost impossible for alien candidates to succeed; and the one period in which success was nearly achieved, when Alfonso X of Castile and Richard of Cornwall both claimed the imperial dignity, is known in history as the Great Interregnum (1254-73). Imperial pretensions were not only impeded by the unnatural localization of the grandiose title; they were further weakened by the incessant rivalry between the empire and the papacy. For a time the balance of success rested with the spiritual power, but every victory gained by the popes, from Hildebrand to Innocent III, was a blow to that fundamental idea of unity bequeathed by Rome, on which the claims of both popes and emperors were based.

**Decline of the German Kingship.** If the union of the Roman Empire with the German monarchy was fatal to the power of the former, it was equally ruinous to the latter. In the 10th century the German king was one of the strongest territorial rulers in



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Otto III, surrounded by clergymen and warriors

Europe; by the close of the 13th century he had become one of the weakest. The causes of this decline are perfectly obvious. In other states the monarchy became normally hereditary, but in Germany this was impossible, because the imperial office was by tradition and by its very conception elective; and the electors were territorial princes, whose desire for independence made them eager to choose a feeble rather than a strong ruler. The kingship in Italy was a disastrous burden on the ruler of Germany. Over and over again the emperors were impelled to leave their northern kingdom in what proved to be a vain attempt to gain substantial power in the southern peninsula. Germany tended more and more to become a loose federation; and the allegiance of the separate princes to the German king became little more substantial than the purely nominal inferiority of national kings to the Roman Empire.

**End of the Empire.** By the 16th century the Holy Roman Empire seemed to be, and was, a complete anachronism. The very conception of unity had been destroyed by the growth of coherent and powerful nations in France, Spain, and England. The Reformation put an end to the ecclesiastical unity of western Christendom. Frederick III (1440-93) was the last emperor who assumed the crown of Italy. The holy crown of Arles had not been worn by any prince since Charles IV (1346-78), and large portions of the kingdom had fallen to France. Frederick III was crowned by the pope in Rome, and his great-grandson, CHARLES V, was crowned by a pope in Bologna; but the ceremony was never afterwards performed. Of the four crowns of the medieval empire that of Germany alone remained; and no emperor after Charles V made any real effort to assert imperial authority outside Germany. The emperors were nothing more than German kings, and even in Germany they had little real power. The empire, as Hobbes put it, was neither holy, nor Roman, nor an empire.

Yet the forms and titles of the Holy Roman Empire were continued with little alteration till the beginning of the 19th century—chiefly because they were so unreal as to excite little jealousy or opposition. There is also another explanation. The idea of the Roman Empire was rescued from the chaos of the 10th century by its association with the then substantial office of German king. It was prolonged after the decadence of the 15th century by its association with a singularly successful family. Twice in the 13th century an emperor had been found in the house of Hapsburg, which then established itself in Austria. In 1438 the choice of the electors fell once more upon a Hapsburg, and for three centuries members of this family held continuous possession of the imperial title. One of them, Charles V, acquired by the accident of inheritance such vast dominions as to inspire a fear that something like a universal empire might once more be created. But the bulk of Charles' territories passed to the Spanish branch of his house; and it was the Austrian Hapsburgs, to whom fell the German provinces, who retained such a tenacious hold of the imperial office. Their quasi-hereditary tenure was partly due to the geographical position of their territories, which made them the natural champions of Germany against the dreaded Turk, and may also be attributed to the skill with which many of them secured the election of their sons as "kings of the Romans" during their own lifetime. When the male line of the Austrian Hapsburgs ended in 1740, a Bavarian prince, Charles VII, held the imperial title for a few years (1742-45), but after his death it reverted to the house of Lorraine, which succeeded by intermarriage to the territories and position of the Hapsburgs.

The great convulsion of Europe, inaugurated at the close of the 18th century by the French Revolution, proved fatal to many interesting survivals from the distant past, and among others to the Holy Roman Empire. When Napoleon became emperor of the

French, and when his conquests made him supreme in western Europe, and a dictator in Germany itself, it became obviously preposterous for an Austrian archduke, even though he was also king in Hungary and Bohemia, to bear titles which purported to carry with them the rule of the world. Francis II, bowing to the inevitable, formally resigned these titles in 1806, and consoled himself with the title of emperor of Austria, which he had already added to his other dignities in 1804.

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**HOLY SEPULCHRE, KNIGHTS OF THE.** See **HOSPITALIERS.**

**HOLY SPIRIT, HOLY GHOST, or PARACLETE,** the third person of the Christian TRINITY, the other two being God, the Father, and the Son (JESUS CHRIST). Although the doctrine of the Holy Spirit is Christian, its roots are in the Old Testament. The Spirit of Jehovah is mentioned as an active, creative principle in Gen. 1:2; in I Sam. 16:13, the Spirit is the generator of the higher energies in a man's soul; in Isa. 11:1, the Spirit is manifested as a prophetic faculty; and in Joel 2:28, the full manifestation of the Spirit is prophesied for the Messianic Age.

In the New Testament the doctrine of the Holy Spirit was developed and the basis for the concept of the Trinity was laid down. The Holy Spirit became the source of extraordinary gifts and powers, as at the day of PENTECOST (Acts 2:4 ff.); it was the principle of the divine life in the community (Rom. 8:10 ff.); and the giver of spiritual graces (Gal. 5:22).

The doctrine of the Holy Spirit did not receive full recognition until the essential divinity of Jesus attained ecclesiastical sanction and the concept of the Trinity was formulated by the early church. The Holy Spirit has been variously interpreted by theologians, but generally speaking, the Spirit has been regarded as God immanent in man and society as contrasted with the transcendent nature of God, the Father. Rationalistic thinkers have sometimes reduced the Holy Spirit to the concept of an innate moral faculty, but such a psychological interpretation is not compatible with a theology based on the doctrine of the Trinity.

The question whether the Spirit proceeds from the Father alone or from the Father and the Son contributed toward the separation of the Roman and the Eastern churches. Some religious groups have stressed the influence of the Holy Spirit. Many of the pentecostal sects maintain that the utterances of their members during worship services are the result of the inspiration of the Holy Spirit. Because of the passage of Scripture which tells of the Spirit "descending from heaven like a dove" (John 1:32) upon Jesus at the time of his baptism, the dove has become the symbol of the Holy Spirit, appearing frequently in Christian art. The Holy Spirit has become important in the doctrines of regeneration and sanctification. In scholastic theology the seven sanctifying gifts of the Holy Spirit are wisdom, understanding, fortitude, piety, counsel, knowledge, and fear of God, based on the Scripture passage Isa. 11:2. These contrast with the "fruit of the Spirit," recorded in Gal. 5:22, which includes the virtues of love, joy, peace, longsuffering, gentleness, goodness, and faith. See THEISM. W. G. D.

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**HOLY THURSDAY.** See **ASCENSION DAY; MAUNDY THURSDAY.**

**HOLY WATER,** signifies water blessed by a priest or bishop for certain religious uses. Sprinkling the hands and face with water before entering the sanc-



tuary, prescribed in the Jewish law for those ceremonially unclean, was early adopted in the Christian church. It is expressly mentioned by Tertullian in the end of the second century; and that the water so employed was blessed by the priests we learn from St. Jerome, and from the Apostolical Constitutions.

In the Roman Catholic church four types of holy water are used: (1) the ordinary kind, sprinkled on the congregation before Mass, used at the door of the church, and used in blessing people and things at church and in the home; (2) baptismal water, used in the administration of baptism; (3) Gregorian water, used in consecration for holy orders (see ORDERS, HOLY); (4) Easter water, which is blessed with special ceremonies on Holy Saturday Eve of Easter and distributed to the congregation. An indulgence of 100 days is granted for the use of holy water.

**HOLY WEEK**, the week before Easter. It begins with **PALM SUNDAY**, commemorating the triumphal entry of Jesus into Jerusalem. Its Thursday is **MAUNDY THURSDAY**, the day of the institution of the Lord's Supper and of the washing of the disciples' feet. On this day there has been, at some times and places, a ceremonial washing of the feet of selected beggars and the distribution of alms. ("Maundy" derives from the Latin *mandatum est*, "it is commanded.") **GOOD FRIDAY** commemorates the Crucifixion. The week ends with Holy Saturday, the day in the tomb.

W. E. GARRISON

**HOLYHEAD**, seaport and urban district, NW Wales, Anglesey County, is situated on the N coast of Holyhead Island on Holyhead Bay. It is the starting point for mail steamers to Dublin, and to Greenore. Its harbor is protected by a breakwater two miles long. Pop. (1950 est.) 10,800.

**HOLYHEAD ISLAND**, or **Holy Isle**, a small island off the W coast of Anglesey County, N Wales, in the Irish Sea; area 15 sq. mi. It is connected with Anglesey Island by rail and road. Tre Ardur, on Penrhos Bay, affords sea bathing and has picturesque golf links.

**HOLYOKE**, city, Massachusetts, in Hampden County, on the W bank of the Connecticut River, the Boston and Maine and the New York, New Haven, and Hartford railroads; and U.S. highways 5 and 202, about eight miles N of Springfield. Holyoke is an industrial center known as "the Paper City" because of its extensive manufactures of paper and paper products. Power for its industries is derived from the Connecticut River. Manufactures include textiles, metal products, hats, leather belting, and sportswear. Holyoke was settled about 1745 by Capt. Elizur Holyoke and Roland Thomas. Mount Tom (1,214 ft.) and Mount Tom State Reservation are located within the city limits. Dinosaur tracks, embedded in a ledge 150 by 30 feet, are of interest. The Holyoke library and museum contains exhibits of wild life and a gallery of paintings. The Belle Skinner collection of old musical instruments is housed in Holyoke. Mount Holyoke College is near by at South Hadley. Pop. (1950) 54,661.

**HOLYOKE, MOUNT**, a steep ridge in Massachusetts, three miles SE of Northampton. A road leads to a resort on the summit.

**HOLYROOD**, royal palace at Edinburgh, once an abbey, and for centuries the residence of the Scottish sovereigns. The abbey, which has been in ruins since 1688, was founded by David I in 1128. The palace was commenced about 1501, and is especially famous as the residence of Queen Mary, and the scene of the murder of her favorite, David Rizzio, in 1566. The palace was mostly destroyed by the English in 1544, and partially destroyed by Cromwell in 1650, but was rebuilt (1671-79) by Charles II after the Restoration. See **MARY QUEEN OF SCOTS**.

**HOLYWELL**, town, N Wales, Flintshire, on the Dee Estuary; 15 miles NW of Chester, England. St. Winifred's well, which appeared, according to

legend, on the spot where St. Winifred was slain by a rejected lover, is enclosed by a Gothic chapel. Holywell has lead and zinc mines, cement works, lime quarries, and manufactures of copper and iron machinery, cotton textiles, and flannel. Pop. (1950 est.) 3,600.

**HOMAGE**, in feudal law, an acknowledgment of tenure made by a tenant by knight-service to his lord upon the investiture of the former. The tenant knelt before the lord who was seated and held both hands of his tenant as the latter pledged to become his man (*homo*) for the lands held of the lord with the only reservation of faith to the king. *Liege homage*, being without such reservation, was due only to the sovereign and its modern counterpart is the oath of allegiance. See **FEUDAL SOCIETY**; **TENURE**.

**HOMBERG**, town, Germany, in the Prussian Province of Rhine, on the left bank of the Rhine River, opposite Duisberg, eight miles NW of Mulheim. It has chemical and coal-mining industries and manufactures of machinery and dyes. Pop. (1946) 26,300.

**HOMBURG-VOR-DER-HÖHE**, town, and health resort, Germany, in the Prussian Province of Hesse-Nassau, at the SE foot of the Taunus Mountains, eight miles NW of Frankfurt-am-Main. It is noted for its eight mineral springs, remarkable for their curative powers. Homburg-vor-der-Höhe consists of an old town and a beautifully laid out new town, founded by Landgrave Frederick II. The former residential castle of the Hessian landgraves, situated on a neighboring hill, was built in 1680. Near the town is the ancient Roman castle of Saalburg. From 1682 to 1866 the town was the capital of the landgraviate of Hesse-Homburg. It was bombed during World War II. Pop. (1946) 16,300.

**HOME, HENRY**. See **KAMES**.

**HOME, Sir PATRICK**. See **HUME**.

**HOME AND HOME LIFE**, the economic and social relationships arising out of family living. The home itself is the center of all those activities which are particularly concerned with the material aspects of daily life, such as the getting of food and clothing, as well as a reflection of the various cultural forms of the period.

The importance of the home as the center of family life arises from the fact that the human infant is completely helpless at birth and must receive care and shelter if he is to survive. The job of raising children has traditionally been assigned to woman, and in most societies it is the woman's function not only to see to the material well-being of her offspring, but to induct him into those forms of behavior which will meet with societal approval. Thus the family orientation originally served as the educative institution in the society, relating the naive child to his culture in terms of how he could survive (technology and economics), the values of life to which he should subscribe (religion and ideology), and the system of relations which ordered the world in which he lived (social organization). Originally the home served all of these purposes, but the trend in modern times, is increasingly to delegate these functions to agencies outside of the family group.

**Home Life Among Primitives**. Among primitive peoples, for instance, the home not only represented the center of all social training for the child, but was the economic unit as well. Division of labor was made along sex lines, the man being the hunter; the woman the homemaker, farmer, and tailor. The harsh environment from which primitive man wrested his livelihood necessitated the education of the child toward meeting the practical exigencies of every day living. This training was largely achieved through imitation; the boys imitated their fathers in the manufacture of weapons, traps and nets used for warfare, hunting, and fishing; the girls imitated their mothers in cooking, weaving, skin dressing and the various tasks of crude agriculture. What social and moral

training the child received, was to a large degree dependent upon the degree to which the group customs had become fixed and authoritative.

**Home Life Among Ancient Peoples.** Much more is known of the home life of ancient peoples than of primitive man. Written accounts of family life are to be found in the Old Testament, the Talmud, and the works of the various Greek and Roman historians and philosophers. The ancient family was highly patriarchal, with women occupying a subordinate role in the activities of the group. In the Hebrew family for instance, wives were frequently grouped along with slaves and children, and within each separate household, division of labor was made on a sex basis. The man pursued agriculture or a trade, and fulfilled such political and religious duties as were required of him as a citizen and head of the family. Under the direction of the Hebrew housewife various productive industries were carried on in the home. The home in ancient times also functioned as a religious institution. Thus, in the Greek family, the father not only derived his authority from the fact that he was trustee of the family estates, but also because he was the center of a closely knit family religious organization bound together by the worship of the family gods around the family altar. Most of the industries of the community centered in the home even in Homeric times. Each well-to-do household had its own cattle, sheep, and goats; its farm and grazing lands, its mill, and its implements for converting raw materials into food and clothing. The distaff and the spindle were in daily use and weaving was highly developed, although the loom was still primitive in form.

As Greek civilization became increasingly complex, the household unit lost its economic entity. Certain industries, producing for home consumption, had developed in Athens as early as the 5th century B.C. Nevertheless, Greek women remained highly productive in the economic sense. They spun and wove, did some of the family cooking, directed the activities of slaves, and managed many of the household affairs. About this time the home also began to lose part of its educative function, with boys being sent to public schools after their seventh year. Girls, however, continued to live a highly restricted life within the limits of the home, and received no definite instruction, except perhaps in cooking. This is a strong contrast to the position of women in Rome after the Punic Wars when Roman society had ripened into empire. The simple restricted home life of the Greek and Roman wife and mother of primitive times is separated by a wide gulf from the almost unlimited social and economic freedom of her sister of this later age. The lavish provision for slave labor in a society which had mastered the major portion of the known world rendered it quite unnecessary for the mistress of such a household to ply her earlier honorable tasks of spinning and weaving, or even to direct the work of her slaves, except as she desired. The villa of a wealthy Roman represented a highly organized economic institution independent of most of the outside sources of industry and supply. Often, it had staffs of expert handicraftsmen for every type of work. In such an atmosphere it was almost inevitable that the mode of living would also change. Nevertheless, in this world of luxury for the upper classes, the wives of the poorer people continued to perform their household tasks as of old, feeding and clothing their families largely by their own efforts.

The trend toward the disintegration of family values in imperial Rome was offset to some degree by the rising ideology associated with Christianity. Emphasizing the spiritual rather than the physical aspects of human life, Christianity created a dichotomy in values relating to marriage, which has not yet been completely resolved. Sex was viewed by some as inherently sinful, and although it was agreed that it was "better to marry than to burn," this admission was made with some reluctance. This ascetic spirit came

into its full flowering during the Middle Ages, when the doctrines of Chivalry and Romantic Love, combined to make a woman more desirable as she became less attainable, and to surround the relationship between the sexes with an aura of spirituality which still exists in some measure to the present day.

**Home Life in Middle Ages.** Home life in the Middle Ages, was largely dependent upon position in the social hierarchy. The nobility spent most of their time within the walls of the fortress-castle, isolated from most of the world, and forced into close association with those within the castle walls. Children of the nobility were trained for the positions they would later assume in life, sons being taught the arts of war, and being trained in courtly refinements; daughters being trained to spin and weave, to make clothing and to embroider, and to take over management of the castle if their lords were called to war.

Life for the common people, however, was rather different. In the later Middle Ages, these people were divided into the trading class, which lived in the rapidly growing towns; the yeomen or free farmers, and the serfs, who were bound to the soil and who owed clearly defined services in labor to their overlord. The burghers constituted the free citizen class of the towns and cities. Skilled in some craft, they nevertheless remained coarse in manner and speech. As they gained in wealth and managed to secure more rights and privileges from the nobles, they began to build substantial homes in the important trading towns, and to secure wider education for their children.

**Home Life in the Renaissance.** The growth of industry and commerce which characterized the later Middle Ages, bore fruit in the Renaissance in terms of a marked improvement in the homes of the middle and upper classes. Some of the more celebrated establishments of the period had delicately carved furniture, splendid plate and glass, and elaborate tapestries and hangings, as well as huge libraries and art collections. Side by side with all this magnificence there existed a lack of sanitary arrangements which would appall the modern man. Sumptuousness everywhere rubbed elbows with dirt and discomfort even though every great family had an enormous number of trained and paid servants.

Wealthy burghers of this period, tried to emulate the magnificence of the upper classes to some degree. As early as the 15th century, merchants in many towns began building fine houses, three stories tall. The ground floor was commonly used as a shop where the owner plied his trade, while the upper stories of the house contained living accommodations for the family.

During this period, women were kept busy with numerous household tasks. Even the great ladies found their time fully occupied in directing the work of servants, keeping accounts of household expenditures and supplies, and brewing medicines. In the absence of their husbands, these women were also expected to keep the buildings in repair, supervise the labor on the land, and replenish the stores. Wives of yeomen and tradesmen were usually occupied from dawn until dusk. They carried on a variety of domestic industries, including curing meats, brewing ale, dipping candles, making soap, baking bread, and doing all of the family cooking. They also spun and wove woolen and linen cloth, and made it into garments for the family.

As in other ages, children of the Renaissance received their early training from their mothers. Relationships between adult and child were highly formalized, with the parents exerting rigorous discipline. Although the emphasis in education was on the humanist tradition and a knowledge of the classics, religious instruction also occupied a great part of the child's training. The penchant for knowledge, however, did not extend beyond the sons and daughters of the upper classes. The common people, for the most part, remained unaffected by the revival of the



classical tradition, and their education was directed toward the more practical aspects of life.

**Life in Colonial America.** The family of the Renaissance and Reformation was strongly patriarchal and very much like the family in colonial America. The family system of 17th and 18th century England was transplanted almost intact to the New World. Women were considered subservient to men, their function in life being to see to the comforts of their husbands. Yet the American colonial family had as its most significant feature its economic cohesiveness. The struggle for existence in a new country demanded co-operation from every member of the family and served to develop a consciousness of a vital common purpose. Economic activity was organized around the farm, with each family building its home, providing its own food supply, and preparing the raw food materials for consumption. The colonial housewife not only baked, cooked, and spun, but prepared candles and clothing. In addition to all these activities, families often made their own furniture, utensils, and metal ware. In the education of the children, scant attention was paid to intellectual attainments, although much time was concentrated upon religious and practical training. It was not until the opening up of the frontier, however, that the American family began to take on a real, democratic character. Both women and children began to enjoy a higher social status; women in the West were often scarce, and as such were more highly appreciated.

**Modern Home Life in the United States.** These democratic gains were fully crystallized with the INDUSTRIAL REVOLUTION, which profoundly changed the very structure of the family and home life. At this point the home began to lose its vital function as the seat of economic productivity. As the factory system took over the old home industries, people left the farms to seek work and concentrated in newly formed urban areas. In 1946, more than half of the population of the United States lived in communities of more than 8,000 inhabitants. With its change of location the family has experienced a multitude of other modifications. The great numbers of persons that go to make up a city and their high mobility serve to make urban contacts highly impersonal. The days of the small, well-integrated community, characterized by primary group contacts, have passed.

Instead, American society places a premium upon individualism and self-realization. The cohesive, highly integrated, and purposive family has given way to a unit more directly concerned with consumption than productivity. While modern home life is losing its economic function, the importance of the home in the personality development of the child has become increasingly its functional core. But even this function is somewhat impeded by the growing use of schools for education, and the fact that the modern city makes possible a wide range of contacts beyond the limits of the family circle. So far as informal training goes, however, the family still maintains its dominant role, and the child's attitudes, manners, and morals usually have their foundation in the home. Gone, however, is the home as a center of religious and recreational activities. In most cities agencies catering to mass needs have developed which have in large part supplanted the home in these respects.

Home life in the large city is today a function of a disintegrating family structure. While women have achieved an equality of status with men, they have also been beset with the problems arising out of maintaining a home and a career at the same time. For many women of course, this is not a problem, since neither financial need nor desire for outside employment draws them away from their homes. The number of employed married women, however, is on the increase. Home life for this group is centered usually about an apartment which is rented and not owned. Community agencies have increased which

service the needs of an employed woman, who may also be managing a home. Groceries are delivered, clothing bought instead of made, canned goods are used in preference to fresh foods which might require involved preparations. For many of the adult members of a family, the home is becoming little more than a place to eat and sleep. On the whole the size of the modern family is also decreasing, and with the advent of the nursery school, home life for many a child stops when he is two or three years old. The disintegrating nature of family life is most starkly revealed by DIVORCE and desertion statistics. In the United States in 1940, one out of every five marriages ended in divorce; an untold number of marriages ended in desertion.

What home and family life of western civilization will be like in the future in view of these trends is difficult to predict. Some anticipate a weakening of family ties and even the eventual demise of conventional family life. They point out that the function of the family originally was the care and protection of the child during infancy, and there are indications that this need is fast disappearing with the organization of nurseries and schools for this purpose. Other authorities, however, feel that the home will play an increasingly important role in the future, but that it will tend to center its activities about the affectional needs rather than the material needs of its members.

**Home Life in China and Russia.** Changes in home life are not particularly characteristic of western civilization. In China, the influence of industrialization and democracy have had their repercussions in family living. The old family unit which was the unit of both production and consumption is rapidly breaking down in the face of the factory system and urbanization. This is also true of the extended kinship relationship which formerly characterized the society. The high respect accorded to old people as sources of the accumulated knowledge of the culture is giving way before a youth imbued with western ideas of marriage, professions and amusements. The importation of a democratic ideology has also served to place women in an equal position to men. No longer are feet bound or women confined to the home and not permitted outside careers. With these developments home life in China is beginning to increasingly resemble home life in America, although the Chinese as yet have a much lower standard of living. As industrialization and urbanization increase, however, it is more than likely that Chinese family living will more closely approximate our own, particularly in terms of material advantages.

The most far-reaching changes in family living have probably been achieved in Russia. Here many of the functions of home and family have been taken over by the state. The Soviet system of social insurance has included many of the special needs of married women workers. Insurance for pregnancy and childbirth cover the mother's needs for a period before and after confinement. Mothers have a legal right to retain their positions during and after pregnancy, and are allotted time off from work to care for their children in factory-operated nurseries. A variety of attempts have also been made to free women from many of their household tasks. Thus commercial kitchens, public dining rooms, mending centers, nurseries, and kindergartens were established by the state. Recently there has been a renewed emphasis on the individual home unit in Russia. Emphasis upon child bearing and rearing has increased. The present trend in the U.S.S.R. seems to be in the direction of a monogamous, patriarchal family unit with a large number of children. See FAMILY; MARRIAGE; RURAL LIFE; URBAN LIFE; NEIGHBORHOOD; POPULATION.

G. CIVIN

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**HOME ECONOMICS**, a broad field of knowledge embracing the activities of the home and the life of the family. Traditionally, in a rather narrow sense, it has been concerned with the feeding, clothing and housing of the individual and the family. In recent years, however, it has laid stress on many other activities: the care and guidance of children, the maintenance of family health, home nursing, the management and use of individual and family resources, the growth and development of members of the family, and the social relationships of individuals. Home economics is based on knowledge supplied by science, art, sociology, economics, psychology, and philosophy. It has unified, reinterpreted, and related this basic knowledge to form a body of subject matter which has as its focal point the betterment of home and family living.

A syllabus of Home Economics prepared by committees of the American Home Economics Association in 1913, and revised by committees of the Association during the period 1935 to 1940, outlines the subject matter under the following major divisions: (1) The Family and Its Relationships, (2) Family Economics, (3) The House, (4) Foods and Nutrition, and (5) Textiles and Clothing.

Home Economics contributes to the objectives of all education through the solution of problems primarily concerned with *home and family living*. It contributes to *general education* when it serves to develop abilities, attitudes, and appreciations which are essential for satisfying personal and family living. It contributes to *vocational education* when it offers educational experiences for family members of all ages and both sexes in preparing them for home living and homemaking.

On the *elementary school level* there is an increasingly greater emphasis on the personal and home living experiences of children in the primary and intermediary grades. In many schools, study activities center around simple projects which may include the making and care of clothing, the care of younger children, the use of family money, the planning, preparation and serving of simple meals, and the planning for family fun on special occasions. Practical programs of homemaking education based on real problems of individual children and their families are becoming more prevalent in the curriculum of elementary schools. These real problems generally revolve around (1) personal needs and (2) family needs. The personal needs are concerned with personality development and include grooming, clothing, health, and recreation, personal social relations, and economic adjustments. The family needs are concerned with home adjustments and deal with housing and home furnishing, child care and development, nutrition and foods, and consumer buying.

It is at the *high school level* that home economics is reaching its greatest numbers. Most schools require students to enroll for one or more years of home economics in either the senior or junior high school, most frequently in the latter. Many schools stress training for homemaking and for wage earning in the later years of high school just prior to the completion of public school attendance and wage earning. Home economics on the secondary school level may be offered as special subjects, as a part of a core on

home life education, or as short units in connection with other courses.

Many experimental core programs with courses adapted to adolescent boys and girls have been organized in recent years. In these programs the teaching of such subjects as music, science, health, art, industrial arts, and home economics have been unified around some central theme related to home and family living, and the content of the separate subjects has been reorganized to contribute to this central theme.

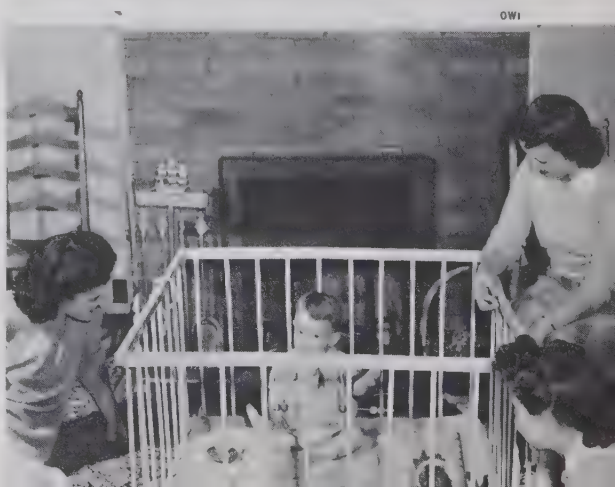
Home experiences have long been an essential part of the home economics program. Many homemaking teachers are employed during the summer months to supervise the home projects of their students. These projects or experiences have many values: they encourage a closer parent-child-teacher relationship; they foster pupil development by broadening the area of their experiences; and they provide opportunity for knowledge and skills acquired in the classroom to be applied to outside situations.

Pupils are contributing to home living in ways that bring a sense of achievement and a satisfaction of creative interests through such individual and group projects as: the planning of an attractive wardrobe, the reduction of the cost of food, the securing of better nutrition, the planning of family good times, the beautification of a room, the house, or the yard; the improvement of the efficiency of the house, the planning of a party or the extending of other forms of hospitality.

Older youth who are returning to school have created a need for postgraduate courses. Many schools are including such courses, and many states have set aside funds to meet this demand. These groups need help with personality and vocational problems, family adjustments, and preparation for marriage. In rural areas, young people need education about growing and processing foods, planning of houses with suitable equipment for farm and semi-rural living. They need help in what to buy and in planning a suitable budget to meet the obligations of any farm-purchasing they may assume. In semirural areas adequate training for rural activities and recreation is essential. In urban districts helpful courses for older youth may be developed in co-operation with community agencies such as nursery schools, child care centers, play centers, and hospitals.

Home economics at the *adult level* serves primarily to help adults assume homemaking responsibilities. Although training for adults may be either general or vocational, it is most often organized for vocational purposes. If adults are to be efficient parents and homemakers, they must keep up with changes in housekeeping techniques, with new ways of maintaining optimum health for each member of the family, with better preparation and serving of meals, with new developments in child care and training,

#### Home economics students learn child care







"ALL THE CHILDREN," N.Y. BOARD OF EDUCATION

**Sewing Classes** held in public schools are an important part of home economics training program

and with other new information which will yield personal satisfactions and result in improved family living.

Homemaking education opportunities for adults have been made available through the following channels: homemaking or family service centers in schools, school-community canneries, separate community centers for adult education, and study programs conducted in homes. Informal methods of assisting adults are being increasingly used. These include personal consultation and clinic-type help on the repair of household equipment and furniture, the selection, care and renovation of clothing, the production and preservation of food, and the guidance of children.

Home economics courses at the college level serve to apply fundamental principles of science, art, economics, sociology, psychology, and philosophy to everyday homemaking procedures.

Colleges and universities offer two types of programs. One is designed to prepare young people for marriage and family life, the other to prepare students for entering the vocations related to home economics. These programs include counseling and guidance services; courses in home life orientation dealing with the study of food, clothing, housing, money management, personal and household buying, human development, and personal adjustments; and courses that focus attention upon modern marriage and contemporary family life. Students are eager to participate in the first hand experiences which colleges offer to provide contacts with homes and family situations. These include contacts and experiences with children, participation in group living in home management or college co-operative houses, and experiences with community projects.

The opportunities for careers in home economics have increased rapidly in the past few years. Well-trained, qualified home economists are in demand in the fields of business, education, social work, and governmental services. Colleges offer various vocational guidance courses to aid students in selecting specific occupations within the broad field of home economics. See the following articles in which further references to related subjects will be found: BAKING; BUDGET, FAMILY; COOKERY; DRESSMAKING; FOOD; HEATING AND VENTILATION; MILLINERY; NUTRITION.

ANNE M. LEE

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27 (1935); "The House," Vol. 27 (1935); "Family Economics," Vol. 28 (1936); "Food and Nutrition," Vol. 32 (1940), "Textiles and Clothing," Vol. 33 (1941); L. F. Baxter, et al, *Our Home and Family* (1943); F. La G. Harris and H. H. Hudson, *New Home Economics Omnibus* (1945); E. M. Cushman, *Management in Homes* (1945); A. M. Kaye, *Shorter Course in Housewifery* (1946); M. B. Jensen, and others, *Fundamentals of Home Economics* (1946); Good Housekeeping Institute, *Good Housekeeping Book* (1947); H. T. Craig, *Practical Home Economics* (1946), *History of Home Economics* (1946), *Creative Careers in Home Economics* (ed. 1947); T. Agan, *House: Its Plan and Use* (1948); C. E. Biester, *Outline of Home Management Principles* (1949); C. Fitzsimmons, *Management of Family Resources* (1950); P. Nickell and J. M. Dorsey, *Management in Family Living* (ed. 1950).

**HOME ECONOMICS ASSOCIATION, AMERICAN**, was founded in 1908 to further the best interests of home and family life and to unite professionally trained home economists in a national association. Its membership in 1951 was about 20,000, with affiliated organizations and college clubs in every state.

The association publishes the *Journal of Home Economics* and is joint sponsor with the United States Office of Education of the Future Homemakers of America, a national organization of high school home economics clubs.

Headquarters of the Association are located in Washington, D.C.

**HOME GUARD**, a term somewhat informally used to designate reserve military formations available for defense of areas near their homes or within the state, and not used for regular military service. Ordinarily they are recruited from men too old or too young for military service, or those having physical defects or those who for other reasons are rejected or exempted from regular service. During the Civil War a number of home guard regiments were raised in various states, some of them officially designated Home Guards. A number of such organizations were recruited in Indiana and Ohio during Morgan's Raid. In World Wars I and II reserve militia organizations were formed in various states after the National Guard was drafted into Federal service.

In England, during World War II, a Home Guard was raised to help repel any Nazi invasion, especially by paratroops. The members of the Guard were armed with privately-owned or militarily obsolete weapons, and were given intensive training in anti-invasion measures. They also performed many routine military duties, thus relieving full-time soldiers for more important assignments.

**HOME OF FRANKLIN D. ROOSEVELT NATIONAL HISTORIC SITE** is beautifully located on a high bluff overlooking the Hudson River near Hyde Park, N.Y., in Dutchess County. It was ded-

### Hyde Park home of Franklin D. Roosevelt

NATIONAL PARK SERVICE



icated on Apr. 12, 1946, when Mrs. Eleanor Roosevelt, widow of the president, presented to the U.S. secretary of the interior a 33-acre portion of the estate surrounding the ancestral stone mansion in which President Roosevelt was born. On the estate Franklin D. Roosevelt lies buried in a rose garden, near a library, which houses his papers and many of his personal belongings.

**HOME OWNERS' LOAN CORPORATION (HOLC)**, an emergency-relief agency of the Federal government under the direction of the Home Loan Bank Board, was created by Congress in 1933. Its general purpose was to provide refinancing loans to victims of the depression who were threatened with loss of their homes through foreclosure of existing mortgages. Long-term mortgages were written at a low rate of interest. During its three-year lending period the HOLC granted more than one million loans, investing a grand total of about \$3,500,000,000. At first many HOLC borrowers experienced difficulties in meeting their monthly payments and delinquencies mounted to a high figure. However, beginning in 1940, large numbers of borrowers were able to pay off their loans in full ahead of due dates.

By the end of 1950 over 99 per cent of the investment had been liquidated, and all of the bonds with which the Corporation financed its operations had been repaid. In 1951 HOLC repaid to the U.S. Treasury the last of its original capital stock of \$200,000,000, and was dissolved. Instead of incurring losses as expected earlier, the Corporation went out of business with a substantial surplus, which was turned over to the Treasury. The HOLC speeded up its liquidation through bulk sales or assignments of its remaining mortgage balances to private financial institutions. The purchasers of these loans agreed to continue for borrowers the same terms as provided in their contracts with HOLC.

**HOME OWNERSHIP.** See HOUSING, *Home Ownership*.

**HOME RULE**, in general, the control of local affairs in any state, county, or other administrative unit, by the people of that unit, rather than by the dominant sovereignty. The term is used especially in connection with the Irish movement for self-government under British sovereignty. The earlier stages of the agitation for Irish self-government are represented by the repeal movement of Daniel O'Connell, the Young Ireland Rebellion of 1848, and the Fenian rising 20 years later (see IRELAND, *History*). In 1873 the term "Home Rule" was invented by Isaac Butt, leader of the Irish Parliamentary party. On the death of Butt, in 1879, CHARLES STEWART PARNELL became the real leader of the Nationalists. The general election of 1885 greatly strengthened the party of Parnell, and he held the controlling influence in the House of Commons. On Apr. 6, 1886, W. E. GLADSTONE introduced his first Home Rule Bill, and thereby broke up the old Liberal party. This bill was defeated on June 7, 1886. Gladstone introduced his second Home Rule Bill in 1893, which passed the third reading in the House of Commons, but was defeated in the House of Lords.

The Third Home Rule Bill was introduced by H. H. ASQUITH's government in April, 1912. It differed in many material respects from Gladstone's measures, chiefly in the absence of any Irish contribution to imperial expenditure, and in the much larger financial powers granted to an Irish government. It provided for an Irish Parliament with a House of Commons containing 164 members, and a nominated House of Lords—such parliament to have power to legislate on all subjects, with the exception of those matters which are not Irish, those subjects which the Imperial government reserves to itself, certain specified matters like treason and foreign treaties, and the endowment of any religion or the establishment of religious preferences. The Imperial government could at any moment pass a law on an Irish question over the

head of the Irish Parliament. Further, the lord lieutenant could veto any law or reserve it for the consideration of the Imperial government; and if the Irish law exceeded the powers granted under the bill it could be quashed by the English Privy Council on appeal. The executive responsible to the Irish Parliament had the whole of Irish administration in its hands with certain exceptions.

This bill passed the House of Commons, but was defeated by the House of Lords in January, 1913. It was reintroduced in May, 1913, and for the second time was passed by the House of Commons and rejected by the Lords. It was again brought before the Commons on Mar. 5, 1914, and on May 25 was passed by a vote of 351 to 274. Under the provisions of the Parliamentary Act of 1911 it then became the law, regardless of the Lords. King George signed the Home Rule Bill on Sept. 18, 1914.

Owing to the violent opposition of Ulster (see IRELAND, *History*), an amending bill was introduced in the British Parliament in September, 1914, which aimed at the exclusion of that province from the operation of the Act. The breaking out of World War I, however, brought the Home Rule question to a standstill. On Feb. 25, 1920, a new Home Rule bill, providing for two separate legislatures—one for Southern and one for Northern Ireland with an Irish Council as a link between the two, was introduced into the House of Commons. It passed its third reading on Nov. 11 and received the assent of the Lords on Dec. 20, 1920. This was not acceptable, however, to Southern Ireland, and further attempts to settle the question resulted on Dec. 6, 1922, in the conclusion of a treaty granting Ireland the same status as the other British dominions. Specific provision was made for the exemption of Northern Ireland from the terms of the treaty. In October, 1922, an Irish Constitution was adopted, and on Dec. 6, 1922, the Irish Free State was formally established by royal proclamation. See IRELAND.

**HOME RULE, MUNICIPAL.** See MUNICIPAL HOME RULE.

**HOMEOPATHY** is a theoretical system for treating disease, founded by SAMUEL CHRISTIAN FRIEDRICH HAHNEMANN of Meissen, Germany. Born in 1755 and graduated at Erlangen in 1779, Hahnemann began about 1800 to announce the theories characteristic of his system. Many of his theories were based upon experiment, some of which he made on his own person.

The Hahnemann system is based on a number of assumptions, of which three are of the greatest importance: (1) That diseases or symptoms can be cured by drugs which produce effects upon the body similar to the disease. This is a revival of Paracelsus' doctrine of signatures. More briefly expressed it is "like cures like" (*similia similibus curantur*). (2) That the effect of drugs is increased by giving them in extremely small doses. (3) That most chronic diseases are nothing more than the evidences of suppressed itch, to which Hahnemann refers as "psora."

Hahnemann's system involves treatment of symptoms rather than underlying causes. The method is not truly a specific method as exemplified by serum, vaccine, and hormone treatments, each directed to a specific infection or deficiency, as the case may be. Homeopathy had at one time a large school of adherents and a number of medical schools and was looked upon with favor by a few outstanding men in medical history, though it was never accepted by the majority of physicians. At the present time there is only one medical school named after Hahnemann, the Hahnemann Medical School of Philadelphia. That school maintains a chair of homeopathic medicine, but teaches scientific modern medicine, and is listed as a Class A school by the A.M.A. Most doctors who were educated in homeopathy now practice along the lines of modern scientific medicine. There are enough homeopaths left, however, to keep open a few distinctively homeopathic drugstores.

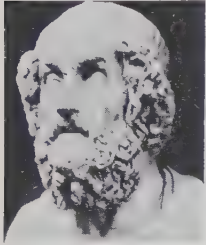


For the most part homeopathy as a system of treatment is a memory of a rapidly receding past. Like many systems of healing which have ultimately proved erroneous, the effects of homeopathy upon medical practice and theory were not all bad. When Hahnemann conceived his theory of homeopathy the prevalent medical practice was to use large doses of powerful drugs, particularly purgatives. Out of the reaction led by Hahnemann came more rational modern therapeutics.

W. W. BAUER, M.D.

**HOMEOSTASIS.** The eminent physiologist, WALTER B. CANNON, proposed that the relatively constant conditions maintained in a healthy organism by co-ordinated physiological processes be designated homeostasis. Like the states of equilibrium reached by simpler physical-chemical systems, homeostasis is maintained by opposing activities that balance one another. Thus an excess intake of water is counter-balanced by an increased elimination through kidneys or sweat glands so that the normal concentration of water in the blood is restored. See BLOOD; AUTONOMIC NERVOUS SYSTEM.

**HOMER**, the name given to the supposed author of the ancient Greek epics, the *ILIAD* and the *ODYSSEY*. Of Homer's life the ancients told much but knew little. He was said to have been a blind bard, wandering from city to city, and getting a living by reciting his poetry.



Homer

"Seven Grecian cities claimed great Homer dead,

Through which the living Homer begged his bread." This couplet well sums up the uncertainty about his life. It is more probable that he was attached to the court of some ruler,

like the bards Phemius and Demodocus in the *Odyssey*. Epic poetry certainly arose among the Greeks on the western coast of Asia Minor, and various facts point to the period 850-800 B.C. as the time when the two epics were composed. The *Iliad* is the older poem. It narrates an episode of the Trojan War. Achilles, a Greek chieftain,

quarrels with Agamemnon, the commander in chief, over the possession of a captured slave girl. Achilles refuses to fight against the Trojans, and in his absence the Greeks are defeated. To avert an utter rout, Achilles allows his friend Patroclus to enter the battle. Patroclus is killed by Hector, the Trojan leader, and Achilles, forgetting his quarrel in the desire for revenge, re-enters the war and slays Hector.

The *Odyssey* tells of the wanderings of Odysseus, one of the leaders of the Greek expedition against Troy. For 10 years he wanders, in a series of marvelous adventures, meeting giants, enchantresses, and devouring monsters. Having lost all his men in these escapades, he arrives safely in his native Ithaca. Here Odysseus finds his wife Penelope beset by many suitors, who suppose that he is dead. With the help of his son Telemachus and a few trusty servants, he kills the suitors and re-establishes himself in his kingdom.

Other poems bear the name of Homer, but are certainly by later poets. These are the Homeric Hymns, short narratives of the adventures of the gods, and a mock epic, *The Battle of the Frogs and Mice*. See HOMERIC CONTROVERSY. HARRY M. HUBBELL

BIBLIOG.—Gilbert Murray, *The Rise of the Greek Epic* (1934); A. Shewan, *Homeric Essays* (1935); J. R. Smith, ed., *Homeric Studies* (1938).

**HOMER, WINSLOW**, 1836-1910, American painter, was born in Boston, Mass. His early interest in art was fostered by his mother, who was an amateur artist. When 19, he went to New York as a lithographer. By his 21st birthday he was doing magazine illustration work for *Ballou's Pictorial* and *Harper's Weekly*. During these early years he studied nights at the National Academy of Design in New York, and later with Frederick Rondel. In 1861, Harper Brothers assigned him to the war front as an artist-correspondent. Many sketches and paintings resulted from his war experience. Perhaps the best example of this period is "Prisoners at the Front." After the end of the Civil War, he returned to New York and continued his career as an illustrator. In 1867, he made his first visit to Europe, spending 10 months in France.

When he returned to America, he settled in Gloucester, Mass., whose scenes of fishermen and sailing ships appealed to an imagination already fired by his youthful fascination for the sea. He spent



PHILADELPHIA MUSEUM OF ART

"The Life Line" is one of the many marine paintings for which Winslow Homer is known

several years in Gloucester, painting many seascapes in water color and in oil. This was followed by his residence in Petersburg, Va., where much of his time was devoted to sketching the Negro life around him. In 1881, he again sailed for Europe, settling in England. Once more he turned his attention to seascapes, and on his return to the United States, he settled near Scarborough, Me., in a small cottage on Prout's Neck. Here he lived the life of a recluse during the spring and summer. At the approach of the Maine winter, he went to Nassau or Bermuda, whose tropical marine scenes offered many opportunities for his sensitive brush. At this time, most of his paintings were of the sea, ranging in subject from the wintry ocean off Scarborough to the tropical waters of Bermuda. His fame was growing, and in 1893 he received a gold medal at the Columbian Exposition in Chicago. Made an Academician in 1864, he was a member of the American Water Color Society and the National Institute of Arts and Letters. Some of his marine paintings are "Fog Warning," "Eight Bells," "Inside the Bar," "Lost on Grand Banks," and "The Voice from the Cliffs." Typical of his Southern sketches is "Cotton Pickers." His work is exhibited in many American museums. See AMERICAN PAINTING.

Winslow Homer's work is fundamentally realistic, a part of the American artistic pattern of truth to objective reality laid down by such of his predecessors as Stuart, Neagle, and Durand. However, realism was only a starting point: Homer organized his visual perceptions into well-designed compositions, setting down his impressions with economy. His years as an illustrator on *Harper's Weekly* may have given this illustrative character to his work. Winslow Homer's best painting was done in water color and was conceived with largeness and spontaneity. See AMERICAN PAINTING; PAINTING; WATER COLOR for illustrations.

HELEN STEWART

**HOMER**, town, SW Alaska, on Cook Inlet, in a fertile agricultural valley. The town is a stop on the Alaska air lines. There are two schools. Gold, copper, and coal are found in the vicinity. More than 150 farmers from middle-western United States settled in the valley during 1936 and 1937. Pop.(1950) 434.

**HOMERIC CONTROVERSY**. Debate over the authorship of the Homeric poems dates back at least to the third century B.C., when the Alexandrian chorizontes attempted to prove that the *Iliad* and the *Odyssey* were by different authors. At that time the critic Aristarchus refuted the "separators" and established the traditional views of the authorship of the poems. This tradition prevailed until the end of the 18th century, when the German classical scholar, FRIEDRICH AUGUST WOLF, in his *Prolegomena ad Homerum* (1795) opened the modern Homeric controversy. Wolf held that the *Iliad* could not have been composed in a primitive age, when writing was unknown; besides, Peisistratus, who ruled in Athens in the sixth century B.C., was said to have collected the scattered poems of Homer, and therefore Wolf contended that there was no one Homer. The Wolfian theory was widely accepted for a time and was supported by Goethe, Schlegel, and other critics. It was gradually supplanted, however, by a revival of the separators' theory. The ingenious analyses of Lachmann, Grote, and other scholars revealed apparent discrepancies between the *Iliad* and the *Odyssey* and suggested that the poems were by a number of different authors. The separatist view is still supported by a large number of classical scholars, but an equally large number firmly believe in unity of authorship, attributing stylistic and factual discrepancies to the modernizing efforts of copyists and to a long interval between the composition of the two poems. J. J. M.

BIBLIOG.—C. M. Bowra, *Tradition and Design in the Iliad* (1930); J. R. Smith, ed., *Homeric Studies* (1938).

**HOMESICKNESS** is a longing to return to the security of the family group. It occurs under many

circumstances, and it is especially common in recruits in the armed services. The separation from protective parental figures is poorly tolerated by children and by adolescents and adults in whom strong dependent attachments have persisted.

Within everyone is the desire to hold fast to a secure and familiar pattern of life and to avoid the unknown. If the new situation is exacting and trying, the longing to return to the security of home is intensified. The loss of personal identity in a large group increases the desire to go back to a situation in which one is regarded as an individual and treated with consideration and affection. In times of severe stress, home may be fantasied as a haven in which every wish to be protected and loved will be gratified.

M. H. HOLLENDER

**HOMESTEAD**, borough, Pennsylvania, Allegheny County, on the Monongahela River and the Pennsylvania, the Bessemer and Lake Erie, the Pittsburgh and Lake Erie, the Union, and the Baltimore and Ohio railroads, adjacent to Pittsburgh. Originally known as Amity Homestead, it was laid out in 1871. In the summer of 1892 Homestead was the scene of a violent strike between the National Amalgamated Association of Iron and Steel Workers and the Carnegie Steel Company. The recognition of the union was the chief issue. The strike, which lasted more than four months, was marked by death and other casualties and ended in a victory for the company. It was an important factor in checking unionism in steel for more than four decades. The chief products of Homestead are steel, heavy mill machinery, cement blocks, tools, and bricks. Pop. (1950) 10,046.

**HOMESTEAD LAWS**, in the United States, are of two kinds. (1) Federal homestead acts under which the unoccupied public lands of the United States have been opened to settlement by bona fide settlers for the purpose of establishing permanent homes. (See PUBLIC LANDS OF THE UNITED STATES, *Sales Policies*.) (2) Laws enacted in most of the states for providing a family security against the loss of a modest home through the claims of creditors, but varying widely in different states. In all cases these benefits are confined to land occupied as a home, and usually only to such lands as are occupied by families. The amount of land which may be thus protected varies in different jurisdictions from 40 to 160 acres, and the money value may be as low as \$500 or as high as \$5,000. The exemption from debts is only partial, certain classes of claims (as mortgages, liens for improvement, taxes, etc.) being enforceable against the homestead.

Canada, Australia, and New Zealand have homestead laws modeled on the American plan.

**HOMESTEAD MOVEMENT**, THE, was early begun by the American settlers who insisted that land should be given without price to those who endured the hardships and dangers of pioneering. Petitions to Congress after 1789 asking for free land were denied because of the adopted policy of using the public lands as a source of revenue. Gradually, however, the movement gained the support of western leaders like Andrew Jackson and Thomas H. Benton, of newspaper editors, and of organized labor. Homestead bills were introduced in Congress. The Free Soil party of 1848 and 1852 and the Republican party in 1856 and 1860 espoused the cause. Finally, after Southern opposition was removed by secession, the long-sought Homestead Law passed Congress and received President Lincoln's signature on May 20, 1862. See PUBLIC LANDS OF THE UNITED STATES.

D. E. CLARK

**HOMESTEAD NATIONAL MONUMENT**, Nebraska, Gage County, three miles NW of Beatrice, about 40 miles S of Lincoln. The monument encloses the first claim awarded a settler under the Homestead Act of 1862. The claim was filed on Jan. 1, 1863, by a Federal soldier, Daniel Freeman, who made his home



on the property from 1865 to 1908. Both he and his wife are buried within the grounds. The monument was established in 1939.

**HOMEWOOD**, city, Alabama, Jefferson County, on U.S. Highway 31, adjoining Birmingham on the S. The city was incorporated in 1921 as Edgewood and in 1926 renamed Homewood to describe its residential character. Pop. (1950) 12,866.

**HOMICIDE**, a general term for the killing of a human being by act, procurement, or omission. Although it is usually understood to be death caused through the agency of another human being, it was considered at one time by common law to include self-destruction (see **SUICIDE**). The term is not applied to those killings by command of the state, such as an execution or the destruction of a public enemy in time of war. Also, in systems of slavery, the death of a slave at the hand of his master was not generally regarded as homicide.

Homicides are usually classified as: (1) *Excusable*, when the result of accident or necessity under circumstances which indicate that the act was not willful or intentional; (2) *Justifiable*, when committed with full intent but under such circumstances as would indicate the act one of duty and proper to be performed, such as in the prevention of murder or other atrocious crime of violence; and (3) *Felonious*, when committed willfully under circumstances that would render it punishable by law.

The distinction between excusable and justifiable homicide is that the former is not without fault or committed as an act of duty, but in which the blame is too slight to render it punishable; whereas, the latter is without fault or is committed as an act of duty. However, the distinction is often disregarded and does not seem to serve any practical purpose. See **MANSLAUGHTER**; **MURDER**.

In 1948, according to the Bureau of Census reports, there were 5.8 deaths by homicide (not including suicide) per 100,000 population. The highest rate reported since 1900 was 8.8 deaths per 100,000 population in 1930.

**HOMILY**, a discourse held with one or more individuals, but in ecclesiastical use a discourse held in the church. The practice of explaining in a popular form the lessons of Scripture read in the synagogues had prevailed among the Jews, and appears to have been adopted in the Christian churches from the earliest times; but we have no example of this form of composition earlier than the homilies of Origen in the third century. Ancient collections of homilies or *homiliaria* are very numerous; the most notable being that compiled about 782 by Paulus Diaconus, under Charlemagne's authority. A large collection of Old English homilies has been left by Aelfric, and much of the literature of the Middle Ages is homiletic.

**HOMING PIGEON**. See **PIGEON**.

**HOMINY**, white Indian corn kernels, broken into particles of uniform size after the fibrous parts and the germ have been removed. Lye hominy is composed of the whole grain hulled by a lye immersion; pearl hominy is the whole grain hulled by machinery. Whole grain hominy finds favor as a dinner vegetable, while the broken kernels or "grits" are used as a breakfast cereal.

**HOMOCLINE**, the sloping of rock strata more or less in the same direction over a considerable area. Homoclines are only found where the earth's crust has been subjected to considerable tangential pressure. They occur in most mountain chains and in many plateaus of Paleozoic strata.

**HOMOLOGOUS SERIES**, in chemistry. The hydrocarbons and their derivatives are remarkable as occurring in families of apparently unlimited size, between the members of which there is a constant difference of composition. Thus, the paraffins, alcohols, fatty acids, etc., form such series, each member and the next higher or lower differing in composition by  $\text{CH}_2$ . For example, the first members of the par-

affins are  $\text{CH}_4$ ,  $\text{C}_2\text{H}_6$ ,  $\text{C}_3\text{H}_8$ ,  $\text{C}_4\text{H}_{10}$ , etc.; the general formula being  $\text{C}_n\text{H}_{2n+2}$ ; and in the same way, the general formula for the alcohols is  $\text{C}_n\text{H}_{2n+1}\text{OH}$ , and for the acids  $\text{C}_n\text{H}_{2n+1}\text{COOH}$ ; and so on for other classes of compounds. Therefore, whenever organic compounds show great resemblance in their chemical properties, differing in composition by  $n \times \text{CH}_2$ , they are said to be homologous. See **HYDRO-CARBON**.

**HOMOLOGY**, a biological principal that is used to establish relationships between the various groups of animals. Homologous structures are those that are similar in structure and origin but not necessarily similar in function. A familiar example is the human arm, the wing of a bird, and the flipper of a seal. Another even more striking example is noted in the appendages of the crayfish. These are all developed on the same plan from a typical biramous (two-branched) appendage. In the adult crayfish, however, the various appendages of the head have become modified as feelers, jaws, and bailers; certain of the thoracic appendages bear gills; others are used for walking, a few of these having in addition claws for defense and offense; the abdominal appendages are variously adapted for swimming and reproduction. A condition such as this, where homologous organs occur on successive segments, is known as *serial homology*. See **ANALOGY**.

**HOMOPTERA**, an insect order formerly classified as a suborder of the Hemiptera. It includes the cicadas, aphids, scale bugs, tree hoppers, leaf hoppers, spittle insects, and others. The members of this order generally have two pairs of membranous wings and piercing and sucking mouth parts with the beak arising from beneath the head. Some families, however, may be entirely wingless (see **COCCIDAE**); others may include certain wingless forms (see **APHID**). Metamorphosis is gradual, although modifications of this type may be found in certain specialized groups, such as the *Coccidae*. All homopterous insects feed on plants.

**HOMOSEXUALITY**, derived from the Greek words for *same* and *sex*, is one of the many concepts that has undergone radical change in the light of modern psychological understanding. Originally it was defined as a sexual perversion manifested in a sexual desire for persons of the same sex. This definition, however, requires some elucidation because the word "sexual" is now being given a much broader meaning by many psychologists. According to them it includes the sum total of all energies, desires, and drives of an individual, only part of which eventually expresses itself in genital sexuality. This sum total is designated as "libido." When its force is directed toward persons of the same sex, the term "homosexual" can be used regardless of its mode of expression. When, as sometimes is the case, this manifests itself in a genital relationship with persons of the same sex, i.e., when there is an inversion contrary to the normal genital desire, then homosexuality is referred to as genital homosexuality or "homogenitality," and the homosexuals themselves as *inverts*. In the popular mind, homosexuality and homogenitality are not clearly differentiated. The above definition reflects this erroneous generalization. Homogenitality is only one form of homosexuality. There are, according to psychoanalysis and other schools of psychology, many other forms, some so masked and sublimated that they are fully acceptable socially.

In contrast to socially acceptable forms, homogenitality is as a rule disapproved by society. As such, homogenitality is a sexual inversion manifesting itself in a desire for sexual gratification with persons of the same sex. Its prevalence is estimated to be 2 per cent of the adult population. It is found in both sexes, though more often among males. Some physical characteristics of the opposite sex may be present in such homosexuals, but this is more consistently true

with regard to psychic characteristics. In speech, dress, personal appearance, and mannerisms homosexuals usually show a meticulous care of details, words, topics of conversation and gestures, all pointing to a marked degree of "refinement." The intelligence of the inverts is usually above average. The choice of occupation tends toward the aesthetic, which is probably an attempt to sublimate that portion of the libidinal interests which does not find expression on a purely genital level.

Depending upon whether the male or the female role is played, homogeneity is referred to as active or passive, respectively, but the most common is the mixed form, in which these roles alternate. Because overt genital homosexuality is met, as a rule, with severe social opprobrium, sexual inverts are forced to form closely-knit social units. In an attempt to conceal their affinities, they even use a special jargon enabling them to conduct a conversation meaningful only to them, which does not arouse the suspicion of the uninitiated. They have their own gatherings or "drags," where dressing in the clothing of the opposite sex, i.e., transvestitism, is often practiced.

There are several theories as to the origin of homosexuality. One theory explains it on the basis of constitutional structure. The underlying assumption of this theory, once stressed by Havelock Ellis, is that homosexuality is basically a matter of hereditary predisposition based on structure. According to this theory the presence in an individual of physical characteristics normally attributed to the opposite sex is an indication of homosexuality. However, actual observations fail to sustain this theory, as the majority of inverts do not deviate physically from what is considered normal for their sex, and many people who possess such characteristics neither do, nor feel inclined to, practice homosexuality. Another theory is based on the fact that both male and female sex hormones are normally present in every individual. According to this theory, the presence of homosexuality or heterosexuality depends upon the relative preponderance of the one or the other hormone. Again we find that while such preponderance might influence the physical characteristics, it does not necessarily imply the homosexuality of the individual so affected. As a matter of fact, pure homogeneity is rare, as most homosexuals can and do lead a genitally bisexual life. It thus appears, that the psychological factor plays the decisive role in determining homosexuality. The psychoanalytic school seems to offer the most fundamental explanation. Viewing the word "sexual" in the broader sense, psychoanalysis considers the sex impulse the end result of a long development during which it passes through several phases. In the earliest, the self-love or narcissistic phase lasting until about the age of four or five, the libido is directed to and centered on oneself. This is followed by a latency period, lasting about four to seven years, during which the libidinal interests are directed socially toward the persons of the same sex, including the parent of the same sex (see OEDIPUS COMPLEX). This is the homosexual phase of development, manifested in boys by the formation of "gangs," and in girls by "crushes." This phase normally prepares the child for a future social identification with the members of the same sex. During puberty and adolescence, the new glandular activity diverts part of the libidinal interests into heterosexual channels, through which is eventually reached the mature heterosexual phase of an individual's psychosexual development. The three phases do not completely supplant each other, vestiges of them manifesting themselves throughout life in various socially useful and acceptable forms. Personal ambitions, choice of occupation, marriage, and family, are the sublimated forms of these phases. Thus psychoanalysis regards homosexuality as a fixation in the normal course of psychosexual development. This may occur when a painful or unacceptable

conflict bars normal progress. Under the impact of the conflict, the individual can adjust only on the level of that phase, in which the conflict did not exist. One may succeed in doing this fully by sublimation in art or some occupation; one may succeed only partially by substituting, for example, homogeneity for heterosexuality, when the fixation occurs on the homosexual level of development; or one may fail entirely, in which case a mental illness supervenes. Surgical or glandular treatment is of no avail. The psychiatric-psychological approach seems to offer the only hope for recovery.

M. KOENIG, M.D.

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**HOMOTAXIS**, in geology, similarity of arrangement or order of succession of fossils or strata in widely separated areas, without actual chronological CONTEMPORANEITY. It was pointed out by Thomas Huxley that since at any given time the flora and fauna prevailing in one region may differ greatly from those in another, the fact that two series of rocks in different regions contain similar assemblages of fossil remains does not prove that the rocks were deposited simultaneously. Huxley called the relationship between the two series of rocks *homotaxial*.

**HOMS**, or **Hems**, Roman **Emesa**, city, W Syria, in the sanjak of Homs, near the Orontes River; 35 miles S of Hama and 90 miles N of DAMASCUS. It is situated in the midst of a fertile agricultural region, which raises wheat, maize, barley, and other cereal grains; there are orchards, olive groves, and vineyards. The town manufactures silk textiles, gold and silver thread, cotton and woolen stuffs, and furniture. An important oil pipe line from Iraq to Tripoli runs through the area. Throughout its history Homs and its plain have been a battleground. At Homs A.D. 272 Aurelian defeated Zenobia, the Syrian queen, in her attempt to drive out the Romans. Homs came under Arab domination in 635 and was at various times in later centuries subordinate to Aleppo, Damascus, and Hama. It was under Egyptian rule from 1831 to 1840. There are ruins of a temple to the sun. Pop. (1943 est.) 100,142.

**HONAN**, province in the S central section of N China; area 62,699 sq. mi.; pop. (1947) 31,806,000. Honan means "South of the River," the Hwang Ho (Yellow River), although part of the province lies north of the river and was formerly also known as Yu or Chungchow (middle district). Honan consists principally of fertile plains, intersected by mountain ranges and tablelands in the northwest, west, and central south. The Sung Shan in the Fu Niu range is one of China's "Five Sacred Peaks."

**River Systems.** The province is traversed by the Wei River and other affluents of the Grand Canal in the north and by the Hwang in the northern, and part of the eastern, sections. The Hwai system drains the southeastern part of Honan and brings the province into river communication with Anhwei in the east. The Pei and Tang tributaries of the Han River form Honan's water communication line to

#### Aerial view of rice fields in Honan Province

THREE LIONS





## Honda

Hupei, especially to the Wuhan cities through the Han River in the southwest. The Lo and Chin drain Honan in the northwest. In the eastern part of the province changing water levels make river transportation difficult or impossible at times, and the Hwang Ho is navigable only for short distances. Great floods and droughts of the Hwang and Hwai rivers have often caused the death of millions of people, mainly through famine, and have led to a comparatively large number of Honan emigrants.

The road system in the province, chiefly used for carts, is good in the east and poor in the west and north, although improved since World War II. The Peiping-Hankow Railway connects Honan with Hopeh and Hupei, and the Lunghai Railway, from Sian (Siking) to Haichow (Tunghai), with Shensi and Kiangsu. A minor line, crossing the Peiping-Hankow Railway, leads from Hwaiking (Tsinyang) northward to Taokow.

**Economic Life.** Honan is like North China in climate, but the winter is mild enough to grow winter wheat. On the eastern plains up to Anyang in the north, especially along the Peiping-Hankow line where the population is densest, rich crops of cotton, wheat, millet, maize, rice, Sesamum, peanuts, beans, and hemp are raised. Silk worms are cultivated on the oak trees of the Fu Niu Shan district. Cereals and fruit also grow on the fertile loam of the west. Coal is mined mainly for local use around Loyang, Liuhokow, Luchan, and Juchow. Besides coal, the province has some iron, tin, lead, copper, and deposits of marble. Nanyang in the south has become a busy commercial and industrial (especially silk) center, and the northeast supplies its cotton industry with home-grown raw cotton.

**History.** Recent archaeological discoveries of oracle bones and tortoise shells in North Honan, some with the traditional list of the names of the Shang kings, have proved that Honan was the chief center of the earliest Chinese civilization. Here Cheng Tang, one of the Shang leaders, organized the first semifederal empire (around 1600-1400 B.C.), and Yin (modern Anyang or Changte) in the north became the capital around 1300 B.C. From the valleys of the Hwang, Hwai, and upper Han rivers Chinese civilization spread along the natural waterways to Shantung in the east and the Yangtze valleys in the south. The northern part of the province owes its important place in Chinese history to its position at the end of the west-east route from central Asia, between Shansi Province and the Chin Ling Mountains and farther on, the Fu Niu Mountains. North Honan was the seat of the capital at times during the Chou, East Han, Chin, Wei, Sui, and Five, Tang and Sung dynasties, or, until the 13th century A.D. The importance of the province gradually decreased because of the more favorable position of China's central provinces.

The Japanese invaded Honan in the winter of 1937, and the provincial capital was moved from Kaifeng, occupied in 1938, to Loyang. The main objects of the Japanese drive into north and east Honan were the seizure of the Peiping-Hankow Railway, the interruption of the western Lunghai line, and the rich crops, which they either removed or destroyed. The main part of eastern Honan suffered long and severely under Japanese occupation. Chengchow (Hwaihang), the strategically important city at the crossing of the Lunghai and Peiping-Hankow railway lines, was captured in April, 1944. After that it was repeatedly bombed by American and Chinese planes.

**HONDA,** town, Colombia, Tolima Department, at the head of navigation on the lower Magdalena, 60 miles NW of Bogotá. The many colonial houses, church ruins, and underground passages are reminders of the town's early Spanish history. Honda has been a trade center for South America for three centuries. Pop. (1947 est.) 13,985.

**HONDO.** See JAPAN.



## HONDURAS

THREE LIONS

**HONDURAS,** a republic in Central America, bounded on the N by the Caribbean Sea and the Gulf of Honduras, on the SW by El Salvador and the Gulf of Fonseca, on the SE by Nicaragua, and on the NW by Guatemala; area about 44,275 sq. mi.; pop. (1950) 1,533,625. For map see Atlas, Vol. 20. For the flag in color, see FLAG.

Except for a narrow strip of swampland along the Caribbean and Pacific coasts, the country is a tableland, broken by broad, fertile plains and valleys and rising in mountain ridges that reach 10,000 feet. The Central American cordilleras traverse the country irregularly in a northwest to southeast direction. Extending south from the eastern Caribbean coast is Mosquitia, an expanse of infertile swamp and prairie, which covers almost one third of the country's total surface. The chief river is the Ulúa, which rises in Gracias Department and flows about 50 miles northeast to the Caribbean. Other rivers flowing north are the Chamelecón, Aguán, Petuca, and Segovia (Wanks). The Goascorán and the Choluteca empty into the Gulf of Fonseca. In the northwest interior is Lake Yojoa, a picturesque finger lake.

The climate is tropical along the coast, with high temperatures averaging 85°; it is more temperate in the mountain areas. The principal rainy season extends from May to September, but near the Caribbean coast rains are more frequent. Annual precipitation varies from 100 to 125 inches along the coast and is slightly lower in the interior.

**People.** Although the average population density in Honduras is 29.8 persons per square mile, most of the inhabitants are concentrated in the coastal regions and about the capital, Tegucigalpa. About 85 per cent of the people are mixed Spanish and Indian and speak mostly Spanish.



Honduran Coat of Arms

### PRINCIPAL CITIES

|                                    | POPULATION<br>1940 Census | POPULATION<br>1950 Census |
|------------------------------------|---------------------------|---------------------------|
| Tegucigalpa, the capital . . . . . | 47,223                    | 72,385                    |
| San Pedro Sula . . . . .           | 20,392                    | 21,139                    |
| La Ceiba . . . . .                 | 11,293                    | 16,645                    |
| Tela . . . . .                     | 8,969                     | 12,614                    |
| Santa Rosa de Copán . . . . .      | 6,018                     | 6,417                     |
| Puerto Cortés . . . . .            | 7,019                     | 12,228                    |
| Choluteca . . . . .                | 5,057                     | 7,075                     |
| Comayagua . . . . .                | 4,758                     | 5,192                     |
| Trujillo . . . . .                 | 4,514                     | 3,016                     |



PAUL'S PHOTOS

### Choluteca Bridge is part of Honduran section of Pan American Highway

Education is free and compulsory from the ages of 7 to 15, but only about one-third of the children of school age attend school. Illiteracy was estimated to be 61 per cent in 1956. There are elementary, high, and normal schools, and the National University at Tegucigalpa, with schools of law, medicine, pharmacy, and engineering. There are also technical, agricultural, military, and commercial schools. The prevailing religion is Catholicism, but religious freedom is guaranteed by the constitution; the state does not contribute to the support of any religion.

petroleum. Lack of economical transportation has delayed the exploitation of mineral wealth.

**Commerce and Industry.** Most of the manufacturing in Honduras consists of small industries to fill local needs. There are factories making soap, cigarettes, matches, candles, shoes, lard, flour, sugar, tinned fish, and beverages. An excellent grade of Panama hats is made in the departments of Copán and Santa Barbara. New industries include textile mills, tanneries, and coconut and vegetable oil factories.

The United States takes more than 70 per cent of the exports of Honduras and furnishes about 80 per cent of the imports. Bananas make up more than one-third of the exports; other products marketed include silver, gold, livestock, coffee, coconuts, mahogany, and tobacco. The imports included cotton manufactures, foodstuffs, machinery, petroleum, wood and paper products, fertilizer, and chemicals.

**Transportation.** With much of the interior of Honduras inaccessible by rail or highway, air transportation has become the main method of moving both freight and passengers. The TACA operates an extensive service from the 38 landing fields in the country. There are fewer than 1,000 miles of railroad in Honduras; the three lines in operation serve the banana ports along the Caribbean coast. There are about 1,000 miles of highways. The completion in 1943 of the Honduran section of the PAN AMERICAN HIGHWAY provides highway connections with Guatemala, El Salvador, Nicaragua, and Costa Rica.

**Government.** Under the constitution of 1936 the legislative power is vested in a unicameral body, the Congress of Deputies, the members of which are elected by popular vote for six years, one for every 25,000 inhabitants. The president is elected for six years by popular vote; he may not legally succeed himself (a provision often honored in the breach). The chief executive is assisted by a cabinet of six. Judicial power is vested in a popularly elected supreme court of five judges, in five appeal courts, and numerous minor courts and magistrates. For administration the country is divided into 17 departments, headed by governors appointed by the president.

Every male citizen between 18 and 55 is liable to military service. The size of the regular army was fixed at 2,500 men, including the national guard, by the Washington Central American Convention

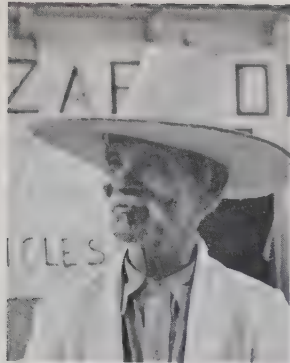


Location map of Honduras

**Agriculture.** More than 90 per cent of the people of Honduras are engaged in agriculture. Bananas, the chief crop, are grown in the north on plantations operated by large fruit companies. Coconuts are raised along the Caribbean coast and on the Bay Islands. Coffee, of good quality, is grown on small farms in the hill country. Some cattle are also raised.

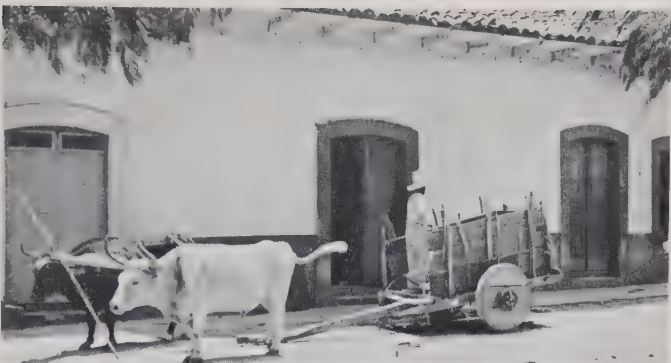
There is an abundance of both hard and soft wood, and forest products are of increasing importance. Mahogany, a great source of wealth of the country, walnut, rosewood, and guayacan are found in the north. The long leaved, or yellow pine, which has a high resin content, grows in the interior. White pine and several varieties of cedar are also found in commercial quantities. An experimental rubber plantation, established by rubber experts from both the





PAUL'S PHOTOS

Native of Tegucigalpa



EWING GALLOWAY

Ox carts are still common sights on streets of Tegucigalpa



THREE LIONS

Honduran soldier



ACME

Army moves artillery during Honduran civil war in 1924



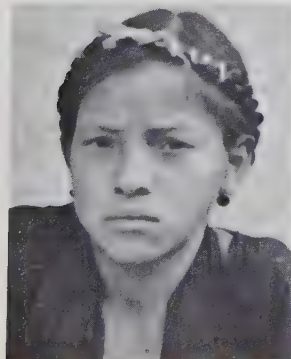
PAUL'S PHOTOS

Negro of coastal region



PAUL'S PHOTOS

Boys unload wood at coastal village in northern Honduras



THREE LIONS

Honduran farm girl



THREE LIONS

Farmers harvest abaca for fibers to be used in making twine

of 1923. There is a small air force and navy. In 1950 American military advisers arrived in Honduras.

**History.** Before the coming of the white men, Honduras was a part of the empire of the MAYAS, who developed a great Indian civilization. One of the centers of Mayan culture and the site of impressive remains is at Copán. The region was discovered by COLUMBUS on his fourth voyage in 1502; the discoverer took possession of it in the name of the king of Spain. The first settlement was established by Cristóbal de Olid, a subordinate of Hernando Cortés, but when the latter heard that his lieutenant was attempting to set up an independent government he hurried from Mexico to assert his authority. Cortés founded Puerto Cortés in 1525 before returning to Mexico. Honduras soon became an important source of mineral wealth for the home country. In 1539 Honduras was made a captaincy general of Guatemala. With the rest of Central America, Honduras threw off the Spanish yoke in 1821; the revolution was bloodless because there were no Spanish troops in the land. At first the Central American states were united with Mexico, but in 1823 they formed "The United Provinces of Central America." On Feb. 6, 1825, the first congress of the new confederation assembled and elected a Salvadoran, Manuel José Arce, as president. In 1838 Honduras withdrew from the confederation, which collapsed the next year. From 1842 to 1844 and again from 1849 to 1852 Honduras was united with El Salvador and Nicaragua. The country has continually been a pawn in Central American power politics and many of its uprisings have been instigated by one or more of its neighbors. The Central American Peace Conference established the Central American Court of Justice for the settlement of all disputes among the five Central American states. Due to the Court, but even more to the influence of the United States, there was peace in the region from 1908. The Court, however, came to an end in 1918.

In 1917 Honduras declared war against Germany but took no part in the fighting. The country signed the peace treaty of 1919 and became a member of the League of Nations, but withdrew in 1938. A revolution in 1919 brought General Rafael López Gutiérrez of the Liberal party into power. Civil strife continued, leading to civil war between rival presidential candidates in 1923. The United States sent a contingent of marines to protect its legation; as a result of American influence peace was finally restored. After 1931, however, numerous unsuccessful uprisings occurred, due largely to the depressed economic conditions. In 1936 a new constitution went into effect. After the outbreak of World War II Honduras co-operated in the program of hemispheric solidarity; immediately after the attack on Pearl Harbor on Dec. 7, 1941, it declared war on the Axis powers, but it took no active role in the struggle. In 1945 the state participated in the San Francisco Conference and it became a charter member of the United Nations. Honduras signed the Treaty of Rio de Janeiro at the Inter-American Defense Conference in 1947. In the 1948 elections the Liberals charged that the government failed to uphold basic civil liberties and therefore refused to vote. Juan Manuel Gálvez was elected president and ended the 16-year tenure of Carlos Andino. The new government began a program to improve agriculture and to develop electrification and the highways. Gálvez was re-elected in 1952 but in 1954 after a period of political confusion he was succeeded by Vice President Julio Lazano Díaz, who became dictator of the country. In 1955 the chief of state issued a decree granting full political rights to women and a basic labor code was adopted to achieve greater economic stability. On Oct. 21, 1956, President Díaz was overthrown by a bloodless coup d'état under the leadership of a three-man council consisting of Gen. Roque Rodríguez, Col. Hector Caraccioli, and Maj. Roberto Gálvez.

**HONDURAS, BRITISH.** See **BRITISH HONDURAS. HONDURAS, GULF OF**, an indentation of Central America, between British Honduras on the NW and Guatemala and Honduras on the S.

**HONE, PHILIP**, 1780–1851, American diarist, was born in New York City. After prospering in an auction business, he retired (1821) and became mayor of New York (1825). He numbered among his intimates Daniel Webster, Henry Clay, and Washington Irving. His diary, kept during 1828–51, describes his activities and gives an important picture of contemporary life. From this diary, preserved in 28 quarto volumes by the New York Historical Society, Allan Nevins selected excerpts, which he published as *Diary* (ed. 1936).

**HONE, WILLIAM**, 1780–1842, a versatile and industrious English writer, was born in Bath. He wrote for various papers, started the *Traveler*, and next the *Reformist's Register*, which quickly carried his name across England by its brilliant political squibs and parodies, and by the caricatures by Cruikshank. Among the more successful of his later satires, all illustrated by Cruikshank, were *The Political House That Jack Built*, *The Queen's Matrimonial Ladder*, *The Man in the Moon*, and *The Political Showman*. The *Everyday Book*, *Table-Book*, and *Yearbook* contained rich stores of information on manners and antiquities.

**HONEGGER, ARTHUR**, 1892–1955, French composer, was born in Le Havre, of Swiss parentage, and received his musical education at the Zürich and Paris conservatories. By 1916 he had won some small recognition, and around this time he became associated with the group *Les nouveaux jeunes*. While under the influence of this alliance, he produced his masque, *Le dit des jeux du monde* (1918), his orchestral *pastorale d'été* (1920), and his oratorio, *Le roi David* (1921), which won him a world-wide reputation. In all of these works Honegger's indebtedness to his model, Bach, is apparent, and this structural influence is evident even in the startling tone-poems inspired by modern life, *Pacific 231* and *Rugby*. Other works include music for such films as *Mayerling*, *Pygmalion*, and *Harvest*; the melodrama *Amphion*; the oratorio *Les cris du monde*; the opera *Judith*; and incidental music for the dramatic play *Jeanne d'Arc au bûcher*.

**HONESDALE**, borough, Pennsylvania, county seat of Wayne County, on the Lackawaxen River, the Erie Railroad, and U.S. highways 6 and 106, about 44 miles NE of Scranton. The city was founded in 1826 when Philip Hone, the mayor of New York City, came to the settlement to urge the construction of a canal to carry coal to New York City. The *Stourbridge Lion*, the first steam locomotive in the United States, made its trial run here in 1829. Located in a farming and dairying region, Honesdale has woolen and knitting mills and manufactures garments, shoes, and oil-refining machinery. Pop. (1950) 5,662.

**HONESTY**, an annual or biennial herb belonging to the family *Cruciferae*. The species *Lunaria annua*, characterized by large purple flowers and ovate leaves, grows wild throughout the United States and is widely cultivated in home gardens.

**HONEY**, a sweet, thick liquid produced by bees and other insects of the same genus. The working bees gather the nectar from the nectaries of flowers, and also sweets from other sources when nectar is scarce, which they carry home to the hive in the crop or honey bag. Here it appears to undergo a transformation, by which it becomes honey before it is disgorged into the cells of the comb.

Honey contains dextrose and levulose (70 per cent), and cane sugar, as also gummy, waxy, coloring matter, and essential odorous oils, along with water (20 per cent) and a minute quantity of mineral matter and pollen.

As an article of commerce and for human consumption honey is presented both in the comb and as run or strained honey. The run honey is separated



from the wax of which the storing cells are composed, by the centrifugal extractor, or by the more tedious and less perfect method of cutting the comb in pieces and running the honey through a bag placed near a fire.

There is great variety in the quality of honey. The product of spring excels that of summer, while most autumn honey is inferior to both, though honey from the fall asters is highly esteemed. The flavor depends greatly upon the flowers which have supplied the nectar; and honey may even be poisonous, when collected from certain noxious plants, as the "Trebizond" honey (from *Azalea pontica*).

The best form of comb honey is that which is termed virgin honey. It is contained in pure white cells of very thin wax, these cells never having been used by the bees for any other purpose than the storage of honey.

Honey is a favorite article of food, and if used moderately is wholesome and beneficial. See BEE.

**HONEY ANT**, a small, light-colored ant of southwestern United States and Mexico which lives in underground chambers. One class of its workers obtains honey from small oak galls, while the *repletes*, another class, stay at home and are used as living storehouses. Fed abundantly, they secrete honey until their crops become swollen into large globes. During the time of winter scarcity, they regurgitate the honey as food for the colony. See ANT.

**HONEY BADGER**. See RATEL.

**HONEY BEAR**, a name for the sloth BEAR.

**HONEYBEE**. See BEE.

**HONEY CREEPER**, a small tropical or subtropical bird of the family *Coerebidae*, found in large numbers in the West Indies. It measures four or five inches in length, is brilliantly colored, and has a sharp slender bill with which it probes for the tiny insects hidden in the corollas of flowers.

**HONEY EATER**, a passerine bird belonging to the family *Meliphagidae*, found in Australia, New Zealand, parts of the Malay Peninsula, and islands of the Pacific. It occurs in wooded country in small flocks. The birds of this family have long, slender bills and protrusible cleft tongues, particularly well adapted for gathering from long-tubed flowers the honey and insects upon which they live. In size the honey eater rarely exceeds the thrush; an example is the parson bird.

**HONEY GUIDE, INDICATOR**, or **MOROC**, a bird of the family *Indicatoridae*, related to the BARBETS and WOODPECKER. They are sober-colored birds, rarely exceeding the lark in size, and are found in Africa, India, and the Malay region. Their excitement when they have discovered a bees' nest leads a honey loving animal like the ratel, or an observing man, to seek the nest, and the birds profit by obtaining the insect grubs from the fragments left behind. Their eggs are laid in the nests of barbets and woodpeckers, instead of in those of unrelated birds, as in the case of the cuckoo.

**HONEY LOCUST TREE**. See LOCUST.

**HONEY POD** or **HONEY MESQUITE**. See MESQUITE.

**HONEYBERRY**, known also as the **JAMAICA BULLACE PLUM**, is the fruit of a West Indian tree or shrub, *Melicocca bijuga*. It is similar in shape and size to a plum, yellow or green in color, and of a pleasant flavor.

**HONEYDEW**, a viscid saccharine exudation which is often found in warm dry weather on the leaves and stems of plants, occurring on both trees and herbaceous plants. It is often, but not always, associated with the presence of aphids, cocci, and other insects which feed on the juices of plants, and its flow is ascribed to their punctures; but the rupture of the tissues from any other cause, such as the state of the weather, seems also to produce it.

Aphids themselves exude by certain peculiar organs (see APHIDS) drops of a fluid which is called honeydew, which probably differs considerably from the direct exudation of the plants on which they feed, but mingles with it where they abound.

**HONEYDEW MELON**, a smooth white MELON with sweet, pale-green flesh. It is one of the muskmelons, probably a form of winter melon, *Cucumis melo*, var. *inodorus*. Production in the United States centers in California, where, in 1945, 3,136,000 crates were marketed. It is also an important crop in Arizona, which produced 832,000 crates in 1945.

**HONEYSUCKLE**, a genus of shrubs belonging to the family *Caprifoliaceae*. One popular species, *Lonicera tatarica*, has thin leaves and fragrant flowers that develop into several-seeded berries. This species thrives best on rocky substrates and sheltered embankments throughout the United States. Another species, *L. dioica*, found on rocky ground, has yellowish or purple flowers and oblong leaves, while yellow honeysuckles, *L. flava*, of climbing habit, found on mountains of southern United States, have yellowish flowers and dark leaves, bluish-green on the lower surface. Several species of honeysuckle are cultivated as ornamentals. They are grown in moist, shaded habitats and are particularly prized for their bright-colored flowers and sweet fragrance.

**HONFLEUR**, seaport and watering place, France, in the department of Calvados, on the S side of the Seine estuary, seven miles SE of Le Havre. Its Church of St. Catherine dates from the 15th century and contains Jordaens' *Jesus in the Garden of Gethsemane*. The town exports farm produce, has a thriving fishing industry, and manufactures chemicals, oil, iron products, ships, and timber. Trade is chiefly with England, and there is regular passenger service by steamship to Le Havre, London, and Southampton. Honfleur dates from the 11th century. During the Hundred Years' War, the town was often in English possession. It was captured by Henry IV in 1590 and again in 1594. Until the 18th century the port was one of the most important in France; now Le Havre outranks Honfleur as a port. Pop. (1946) 8,500.

**HONG KONG**, British crown colony, one of the world's greatest seaports, an island about two miles off the SE China coast, the adjacent Asian mainland territory, and some islets; at the E side of Canton estuary, South China Sea; 100 miles S of the Tropic of Cancer, about 85 miles SE of Canton and opposite Macao, Portuguese port at the other side of the estuary. In general usage, the term Hong Kong is applied to the port; actually, it is the name of both the main island and the colony. The latter (about 391 sq. mi.) comprises: Hong Kong Island (about 3 mi. N to S and 11 mi. E to W, 32 sq. mi.), Stonecutters Islet, and the little mainland peninsula of Kowloon (about 3 sq. mi.), all British territory; and the adjoining (mainland) New Territories (356 sq. mi.), including some islets, leased from China in 1898 for 99 years.

The estimated civilian population in 1940 of the colony was 1,071,893, comprising 1,047,768 Chinese and 24,125 British and other non-Chinese. This total comprised: Hong Kong Island, 456,450 Chinese, 9,920 non-Chinese; Kowloon, 379,816 Chinese, 12,309 non-Chinese; New Territories, 111,502 Chinese, 524 non-Chinese; floating (junk dwellers, etc.), 100,000 Chinese, 1,372 non-Chinese. In 1950 the total population was estimated at about 1,800,000, including about 9,500 western British, 3,000 Macao Portu-



Honey creeper



AMER. MUS. NAT. HIST

Hong Kong Harbor



EWING GALLOWAY

Family keeps poultry aboard their sampan home at Hong Kong



EWING GALLOWAY

Wharf scene at the great seaport of Hong Kong



EWING GALLOWAY

A street in the business section of Hong Kong



H. ARMSTRONG ROBERTS

Mourners carry funeral palanquin or bier along Hong Kong street



EWING GALLOWAY

Restaurant in Hong Kong



guese British subjects, 800 Portuguese, 200 Americans, 125 of indefinite status, and 2,000 aliens who made their permanent home there.

**Features of Interest.** The harbor, one of the best in the world, with entrances at the east and west ends, is some seven miles long (E to W) and about two miles wide, between Hong Kong Island to the south and Kowloon to the north, the narrowest part, Lyceomoon channel, being about half a mile wide. The colony is hilly in places, with a subtropical climate: the hot, rainy season lasts from May to October; the remainder of the year is comparatively dry and cool; typhoons occasionally strike with terrific violence. The colony has good road, bus, and streetcar systems; a railroad runs from Kowloon to Canton and Hankow, some 600 miles north on the Yangtze River; an extensive ferry system connects Hong Kong Island with the mainland. There are two cities: Victoria, the capital, on Victoria Bay, Hong Kong Island, and Kowloon, on the mainland, facing each other across the harbor. Victoria is a modern, cosmopolitan city with British and Chinese features, picturesquely situated between The (Victoria) Peak (1,800 ft.) and the bay. Hong Kong's points of interest include a fine view from The Peak, the vast water front activities, the "native" cities, the so-called "gay quarters," the Repulse Bay resort district, and the tremendous junk population. Hong Kong has been noted in the Far East for its social and club life and for its wealthy British and Chinese residents. Hong Kong was long a haven for Chinese political refugees.

**Economic Life.** The prosperity of Hong Kong, which, with Kobe, Shanghai, and Singapore, has been one of the four great entrepôts of the Far East, mainly accrued from its manifold shipping activities, ranging from junk and China coast traffic to world-wide commerce. Its position as a great transshipment center for cargo and passengers for the southeast Asian land and sea regions has been largely due to the proximity of Canton, without a deepwater port; Hong Kong handled between 90 and 100 per cent of Canton's foreign trade. The Hong Kong and Shanghai Banking Corporation, founded in Hong Kong in 1864, has been one of the chief instruments of British economic strength in the Far East. Hong Kong has been a scheduled port of call for the shipping of Britain, the United States, Japan, Canada, and other maritime nations, and for British and American air services. In 1931, 41,934,000 tons of shipping called at the port. This declined to 21,900,000 tons in 1940, because of the war between China and Japan, during which the Japanese occupied Canton, and other unsettled world conditions in the intervening decade. The chief items in Hong Kong's trade included: sugar, cereals, flour, tea, fishery products, preserved ginger; vegetable and mineral oils; cotton, silk, woolen, and hemp goods; coal, cement, fertilizers, gunny sacks, matches, firecrackers, Chinese and other medicines, paper, camphor, hides, leather, rattan wares, machinery; steel, tin, and wolframite. The main industries are ship construction and repair; fisheries; the manufacture or refining of sugar, tobacco, flour, rope, cement, tin, textiles; and some agriculture. Of the imports, some are consumed in the colony, some transshipped, and some re-exported after processing. The latter and goods produced in the colony comprise Hong Kong's exports. This trade, with China, Japan, Siam, Indochina, and other Far Eastern countries, and nearly all other nations of the world, was valued at \$170,000,000 for imports and \$140,800,000 for exports in 1938, the last normal year before World War II; imports in 1949 totaled \$628,679,000; exports \$528,601,000. Normally about 10 per cent of China's foreign trade passes through Hong Kong.

**The Government** consists of a British governor aided by an executive council (made up of official and nonofficial members); committees (one of which is Chinese); a legislative council; and courts, in-

cluding a supreme court. While under Japanese occupation in World War II, Hong Kong was administered by a Japanese military governor. It is a free port, except for tobacco, liquors, and a few luxuries; duties on these goods, taxes and other imposts, and an opium monopoly provide the government's revenue. The schools, including the University of Hong Kong, number about 1,270.

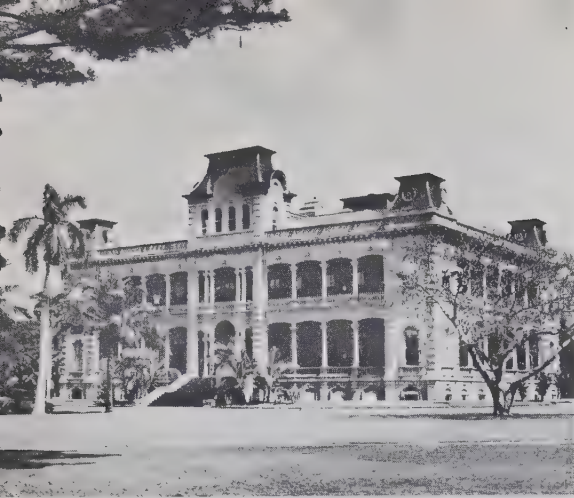
**The History** of this wealthy colony began a little over a century ago. Europeans carried on lucrative silk and tea trade at Canton from the 17th century, the East India Company handling the British share. But in 1833 the British government sent a commissioner to Canton to take charge of the trade. Thereafter frequent clashes occurred between the equally obdurate Chinese and British, the historic episode of which was the destruction by the Chinese of a large quantity of British-imported opium, in 1839. These dissensions culminated in the Anglo-Chinese (so-called Opium) War of 1839-42. This was ended by the Nanking Treaty of 1842, opening Canton and four other ports to British trade and giving Hong Kong island to the British, who claimed they needed it as a place to careen their ships. Prior to the hostilities the British had anchored their vessels in the Hong Kong roadstead. Before that the island was merely a haven for fishermen, pirates, and opium smugglers. The other parts of the colony were obtained by the British in later pacts with the same Manchu government of China.

When Japan attacked Great Britain and the United States in 1941, Hong Kong was besieged and surrendered on December 25. The Japanese committed many excesses, and most of the British and Americans were incarcerated in the notorious Camp Stanley. Several hundred of them were repatriated by Japanese liners, connecting with the exchange ship *Gripsholm's* two voyages, 1942-43. The British recovered Hong Kong after Japan capitulated in 1945. American planes bombed the port frequently during the war. In 1946 the civil administration of the colony was resumed by the British. The establishment of a Communist government in China in 1949 brought unrest and increased Communist infiltration in the colony. The blockade against Communist China created a worsening of economic conditions in Hong Kong. At the same time the colony was menaced by Communist Chinese troops along its mainland frontier. P. W.

**HONNINGSVAAG**, fishing center, N Norway, on the SE coast of Magerøya Island, at the mouth of the Porsanger Fjord, separated from Finnmark County by a narrow sound. Prior to World War II, the town was a thriving Arctic food-supply and coal-refueling station for ocean liners. There were ship repair yards, a large guano plant, and herring fisheries. The town was occupied by German forces in 1940 and completely destroyed by them in 1944 as they were retreating from Finnmark. The work of rebuilding Honningsvaag began in 1946. A new system of docks, a power station, a deep-freezing plant, canneries for processing fish and herring oil, and modern homes for workers in these industries, have been built. A new manufacture, utilizing fish scales as a decorative "pearl essence" in making jewelry, knife handles, toilet sets, and many other fancy articles, has been established. Pop. (1944 est.) 5,000.

**HONOLULU**, capital and largest city of Hawaii, seat of Honolulu County; on the SE coast of Oahu Island, 2390 miles WSW of San Francisco. The city is connected by steamship and airplane service with the U.S. mainland, Asia, and Australia as well as with the other Hawaiian islands. Honolulu is the seat of a Protestant Episcopal bishop and a Roman Catholic vicar apostolic. The population is racially heterogeneous, including Japanese, Chinese, Portuguese, English, and Germans as well as Polynesian and Caucasian Americans. Pop. (1950) 248,034.

**Features of Interest.** The city stretches for several miles along the shore between the sea and the moun-



Formerly a royal residence, Honolulu's historic Iolani Palace serves as the state capitol of Hawaii

tains. The surrounding scenery is tropical in character and the residential sections of the town are beautified with trees and gardens. The climate is healthful and equable. In Palace Square, the civic center, stands the ornate Executive Building, formerly the Royal Palace, about which much of the Islands' history centers. In or around the square are other government and public and semipublic buildings, including the Judiciary Building, before which stands a statue of Kamehameha I; the Archives Building; and the Library of Hawaii. Of particular interest are the old Kawaiaho Church, where services are still conducted in the Hawaiian language, and the Bishop Museum, containing one of the best Hawaiian and Polynesian ethnological collections in the world. There are beautiful drives, parks, and playgrounds, the largest being Kapiolani Park. Honolulu's well known Waikiki Beach, is a world-famed resort, noted for its surf boating. The United States Army and Navy occupy a conspicuous part in the city's life, because of its nearness to Pearl Harbor (naval station) and Schofield Barracks (military post). The public school system is excellent and there are numerous fine private schools.

**Economic Factors and History.** Honolulu is a distributing center for the islands. Imports from the mainland are received there for transshipment, and agricultural products, principally fruit, coffee, and sugar, are gathered there for export to the mainland. The bulk of Hawaiian trade with foreign countries is handled through Honolulu. The city is a crossroads for transpacific steamer and airlines and the center of interisland transportation. Ironworks, pineapple canneries, and sugar refineries are the most important industries. The city's many hotels testify to the contribution of the thriving tourist trade to the local economy.

The harbor of Honolulu was discovered in 1794, but the settlement was little more than a village until after 1815. In 1820 it became the capital of the Hawaiian Islands.

**HONORIUS.** See POPE.

**HONORIUS I**, d. 638, pope, was born in Cambragna, Italy. Although his reign from 625 to 638 was accomplished and ended with good repute, notoriety was given his name after he died. The Sixth General Council, held in 680, condemned Honorius as a heretic because of a letter he wrote to Sergius, the patriarch of Constantinople. Sergius had requested advice about the use of an expression relating to the Incarnate Word which was used as refutation against the MONOPHYSITE heresy and which he believed to be against Christian doctrine. Honorius answered undogmatically, neither defining nor denying. However, it has been established since that he was not speaking *ex cathedra*, and therefore papal infallibility was not involved. See MONOTHELETISM.

## Hooch

**HONORIUS II**, d. 1130, pope, was born in Fagnano, Italy. Brought to the throne by the force of one of the two powerful factions in Italy, Honorius was "elected" by the Frangipani party after they had torn off the robes of the opposing clan's candidate, "Celestine II," during his coronation. The election was made canonical when Honorius' rival died soon after and Honorius ruled from 1124 to 1130. A capable churchman, he had been a canon of the Lateran, archbishop of Bologna, bishop of Ostia, and a cardinal. The pope faced the difficulty of supporting the claim to the imperial throne of one of two princes, Frederick of Hohenstaufen and Lothair, duke of Saxony. When Lothair gave assurance of backing the Concordat of Worms, an agreement to rectify disciplinary problems in the church, the pope recognized him. Honorius also lent his support to the side of Louis VI of France in a dispute with the French bishops, for which he was openly condemned by the famed St. Bernard of Clairvaux, leader of a group of religious called the Cistercians. Although the pope's diplomacy solved foreign governmental disputes, he had no influence at home to settle the state of anarchy among the feudal lords of Italy. He retreated from this problem to a monastery and died there.

R. M. LEONARD

**HONORIUS III**, d. 1227, pope, was born in Rome. His election in 1216 was effected by a compromise, the power of final choice being given by the college to two cardinals. Honorius had been a cardinal himself presiding over the church of SS. John and Paul, and was more than 80 years of age when elected pope. Frederick II of Germany was the pope's enemy through Honorius' entire reign. During his pontificate the pope approved the religious orders of St. Dominic's Friars Preacher (see DOMINICANS), the Friars Minor of St. Francis (see FRANCISCANS), and the Carmelite Friars (see CARMELITES). With a desire to free the holy places of Palestine, Honorius preached a crusade. Frederick, meanwhile, had designs on Italy and foresaw their fruition if he came to the pope's assistance. Agreeing to lead a crusade against the Saracens if he were made emperor, he was solemnly crowned by Honorius in 1220. The agreement was only a ruse and the pope died without seeing the fulfillment of his wishes.

R. M. LEONARD

**HONORIUS**, in full, **Flavius Honorius Augustus**, A.D. 384-423, emperor of Rome from 395, was the second son of Theodosius the Great, from whom he received the western half of the Roman Empire. His reign is noteworthy chiefly for the inroads of the Goths, under ALARIC I and under Rhadagaisus. The former was checked and the latter defeated by Stilicho, who was the real ruler of the empire during Honorius' youth. But in 408 Stilicho was executed on a charge of conspiracy, and in A.D. 410 Alaric sacked Rome. The reign saw the practical loss to the empire of Spain, Gaul, and Britain, the beginnings of a systematic persecution of the pagans, and the abolition of gladiatorial contests.

**HONSHU.** See JAPAN.

**HONTHORST, GERARD VAN**, 1590-1656, Dutch painter, was born in Utrecht, and studied under Abraham Bloemaert, and also in Rome, where he gained the name of "Gerardo dalle Notti" from the circumstance of his painting principally night pieces. Charles I invited him to England, where he was employed in painting Whitehall with allegorical pictures. He was an excellent colorist in the style of Caravaggio.

**HOOCH, PIETER DE**, 1629-d. after 1677, Dutch painter, was born in Rotterdam. In 1653 he settled in Delft where he met the painter, Vermeer, who taught him the tricks of natural lighting apparent in "Woman Tending her Child's Hair." In this picture, as in "Interior," there is a double lighting effect. Prices for paintings were low in this period and de Hooch, unable to earn a living with his art, became a domestic servant. His master, Justus de la



Grange, allowed him several hours a day to paint, however. De Hooch had married a year after his arrival in Delft and upon the death of his wife in 1667 he moved to Amsterdam. One of the earliest of the "Little Dutchmen" of the 17th century, he was a master of genre paintings showing Dutch homes, streets, and everyday activities, all subjects which had been rarely portrayed before. The best of his minutely detailed and cleverly lighted interiors, such as "In the Pantry," were created during his Delft period. After he settled in Amsterdam, a more turbulent city, de Hooch gave figures more importance in his paintings. See DUTCH ART.

**HOOD, JOHN BELL**, 1831–79, American soldier, was born in Kentucky, and graduated from West Point in 1853. Entering the Confederate army in 1861, he became a brigadier general, and was severely wounded at Gaines' Mill, at Gettysburg, and at Chickamauga. He was made lieutenant general and succeeded General J. E. Johnston in command of the Confederate forces around Atlanta. Although the plans of his campaign were sound, Hood was repulsed after severe fighting in the battles of Peach Tree Creek and Atlanta, and was forced to evacuate the city on September 1, 1864. He was later defeated by Thomas at Franklin and Nashville, Tennessee, when he attempted to cut Sherman's communications.

**HOOD, RAYMOND MATHEWSON**, 1881–1934, American architect, was born in Pawtucket, R.I. A graduate of the Massachusetts Institute of Technology and the École des Beaux-Arts, he established his reputation with his prize winning design for the Chicago Tribune Building done in collaboration with John Mead Howells in 1922. He later designed the New York Daily News Building and was one of the leading architects of Rockefeller Center in New York.

**HOOD, Sir SAMUEL**, 1st VISCOUNT HOOD, 1724–1816, English admiral, elder brother of Lord Bridport, took part in Anson's action off Cape Finisterre (1747), and in the action off Louisbourg (1756). In the following year he attacked and drove on shore the French ship *Aquilon*, and in 1759 captured the *Bellona*. He was made rear admiral in 1780. In 1782 he repulsed De Grasse in a brilliant action at St. Kitts. In 1788 he became a lord of the Admiralty, and in 1793 he captured Toulon and the French fleet which lay in port, and effected the reduction of Corsica. In 1794 he reached the rank of admiral, and in 1796 was appointed governor of Greenwich Hospital and was also created a viscount of Great Britain.

**HOOD, THOMAS**, 1799–1845, English poet and humorist, was born in London. In 1821 he became subeditor of the *London Magazine*. To it he contributed verse, and through it he became acquainted with Charles Lamb. In 1825 he published, in collaboration with J. H. Reynolds, *Odes and Addresses to Great People*. The two series of *Whims and Oddities* (1826–27) were entirely his own. In 1830 appeared his first *Comic Annual*. His novel *Tylney Hall* was written during a residence in Wanstead, Essex. From 1841 to 1843 he edited *The New Monthly Magazine and Humorist* and in 1844 began publishing *Hood's Magazine*, to which he contributed his celebrated "Bridge of Sighs." Many of his best-known poems, such as "The Song of the Shirt" and "The Lay of a Laborer," were written for *Punch*. Hood was unrivaled as a punster, and he possessed a singular power of combining the humorous with the pathetic.

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**HOOD COLLEGE**. See COLLEGES.

**HOOD, MOUNT**, summit, Oregon, in the Cascade Range, an extinct volcano (11,253 ft.), standing just S of the Columbia River, 50 miles SE of Portland. Its snow-capped peak was a landmark for pioneers who settled the Northwest.

**HOOD RIVER**, city, N Oregon, county seat of Hood River County; on the steep terraces above the

Columbia River, the Union Pacific and the Mount Hood railroads, and U.S. Highway 30, about 60 miles NE of Portland in an important fruit-growing region. From the heights of the city, Mount Hood, the highest point in Oregon, may be seen 26 miles to the south. Hood River is a fruit-packing and shipping point for the famous apples grown in the region. A branch experiment station of the state agricultural college is located here. Pop. (1950) 3,701.

**HOODED WARBLER**, a conspicuous WARBLER of the eastern United States. It is readily identified by its black hood and throat, bright yellow face and belly, and olive-green back and wings. It nests in bushes near the ground, and lays speckled eggs.

**HOOF-AND-MOUTH DISEASE**. See FOOT-AND-MOUTH DISEASE.

**HOOFs** are the solid envelopes which, in the majority of ungulates, encase the extremities of the digits, and replace the nails or claws of other mammals. They are insensitive, and form a strong surface on which the weight of the animal is supported, so that functionally they are to be regarded as an adaptation to the digitigrade position. Like nails, they are renewed behind as they are gradually worn away in front. They are utilized for the production of glue, gelatin, etc.

**HOOF, PIETER CORNELISZON**, 1581–1647, Dutch poet and historian, son of a burgomaster of Amsterdam. He was mayor of Muiden, where he gathered round him a literary circle, including Vondel and Huygens. He was the author of pastorals (*Granida*, 1605), tragedies (*Geeraerd van Velzen*, 1613), romantic verse (*Gedichten*, 1636), and a valuable account of the Dutch revolt against Spain (*Nederlandsche Historien*, 1642).

**HOOGHLY**, or **Hugli**, town, India, Bengal Province, Hooghly District, on the right bank of the Hooghly River, 24 miles by rail N of Calcutta. Hooghly College is at Chinsura, a part of the municipality. A Portuguese church and a monastery formerly used by the Augustinians are of interest. Pop. (1941), with Chinsura, 49,081.

**HOOGHLY RIVER**, or **Hugli**, India, Bengal Province, the most westerly of the deltaic arms of the Ganges. It is formed by the meeting of the Nadia rivers (the Jalongi, the Bhagirathi, and the Churni) some 155 miles north of the Bay of Bengal and empties into a 35-mile long estuary. The Hooghly is the most navigable of the arms of the Ganges, affording safe passage for deep draft vessels to Calcutta. The tide in the dry season ascends 17 miles north of Calcutta. During the southwest monsoon, a seven-foot high tidal flood speeds upstream at the rate of 22 miles an hour. Shoals at the mouth of the Hooghly require constant dredging.

**HOOK, THEODORE EDWARD**, 1788–1841, English author, was born in London. His wit and powers of improvisation won him the appointment by the prince regent as accountant-general and treasurer of Mauritius with a salary of about £2,000, but he had to resign (1817) owing to the defalcations of a clerk, and he thereafter edited *John Bull*, which achieved great success. Arrested a second time for the same debt, he was imprisoned for two years, when he began *Sayings and Doings* (1824–28), his most popular work. Later he wrote about 38 volumes. His best novels are *Maxwell* (1830), *Love and Pride* (1833), *Gilbert Gurney* (autobiographic, 1836), *Jack Brag* (1837), *Gurney Married* (1838), and *Peregrine Bunce* (1842).

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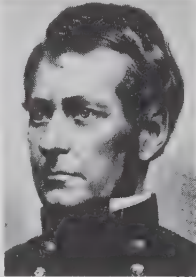
**HOOK OF HOLLAND**, or **Hoek van Holland**, peninsula and North Sea port, the Netherlands, in South Holland Province, at the mouth of the New Waterway, 17 miles NW of Rotterdam. Occupied by the Nazis during World War II, the area was liberated by Canadian troops in May, 1945. Pop. (1945 est.) 3,000.

**HOOKAH**. See PIPE, TOBACCO.

**HOOKE, ROBERT**, 1635–1703, English experimental philosopher, was born in Freshwater, Isle of Wight, and studied at Christ Church College, Oxford. He became curator of experiments with the Royal Society (1662) and professor of geometry at Gresham College (1665). He also served as secretary to the Royal Society (1677–82). Among his numerous inventions were the first screw-divided quadrant, an anemometer, a weather clock, the anchor escapement of clocks, and a universal joint. He was the first to apply, about 1658, the spring-balance wheel to watches. By showing that the earth's center of gravity may be considered a point on the ellipse around the sun, Hooke perceived before Newton the true doctrine of universal gravitation. He also discovered the law of elasticity, which states that the amount by which a body is stretched is directly proportional to the weight applied (see **ELASTICITY**; **HOOKE'S LAW**). He first used the term "cell" in his great work on microscopy entitled *Micrographia or Some Physiological Descriptions of Minute Bodies* (1665). R. Waller edited his *Posthumous Works* (1705). See **BOYLE, ROBERT**.

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**HOOKE, JOSEPH**, 1814–79, American soldier, was born in Hadley, Massachusetts, graduated from West Point in 1837, and served in the Florida War and the Mexican War. He resigned from the army in 1853 and for some time was a farmer in California. In 1861, after the outbreak of the Civil War, he was appointed brigadier general of volunteers. The skill and bravery he displayed in the Peninsular Campaign afterward won him the nickname "Fighting Joe" and promotion to major general. In 1862 he was made a brigadier general in the regular army, and in 1863, after Burnside's defeat at Fredericksburg, he was given command of the Army of the Potomac. Hooker reorganized the army and laid sound plans for a campaign. At Chancellorsville, however, his inaction resulted in his defeat by Lee, who had less than half as many men. While following Lee into Maryland he resigned when reinforcements from Harpers Ferry were refused him. Transferred to the West, he displayed great brilliance as a corps commander under Thomas and Sherman in the Chattanooga and Atlanta campaigns. At his request he was relieved from active duty after he was passed over as successor to McPherson. He retired from the army in 1868.



CHICAGO HIST. SOC.  
**Joseph Hooker**

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**HOOKE, RICHARD**, 1553–1600, English Anglican clergyman, was born in Heavitree, Devonshire. He was educated at Oxford and for a time was lecturer of Hebrew there. In 1585 he became master of the Temple Church, London, and later preached at Boscombe, Wiltshire, and Bishopsbourne, Kent. His outstanding work was *The Lawes of Ecclesiastical Polity*, a philosophical discussion of church government which shows profound thought and masterly logic. In it he defended episcopacy on the grounds of its primitive antiquity and practical value. His writings had a great influence on 18th-century English civil and ecclesiastical political thought. An outstanding biography of Hooker was written by Isaak Walton in 1665.

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**HOOKE, THOMAS**, 1586–1647, American theologian, one of the founders of Connecticut, was born in England. He was graduated from Emmanuel

College, Cambridge, in 1608, and preached successively at Esher, Surrey (1620–26), and at Chelmsford, Essex (1626–29). Having been arraigned as a Puritan by the ecclesiastical authorities, he went to Holland in 1630, and from there emigrated to New England in 1633, where he became pastor of the first church at Newtowne (now Cambridge), Mass., and was prominent in both ecclesiastical and civil affairs in the colony. Becoming discontented with conditions in Massachusetts, he led his congregation and others to what is now Connecticut, and there founded Hartford, where he was pastor until his death. In 1639 he caused the adoption of the Fundamental Orders of Connecticut, and later was one of the organizers of the United Colonies of New England. Hooker published sermons and theological treatises, the best known of which is his *Survey of the Summe of Church Discipline* (1648).

**HOOKER, Sir WILLIAM JACKSON**, 1785–1865, English botanist, was born in Norwich. He was appointed professor of botany at Glasgow University in 1820. In 1841 he became director of the Royal Gardens at Kew, and by his energy and enthusiasm extended this famous botanical garden from 11 to 75 acres. He also founded the first Museum of Economic Botany (1847). Among his publications were *Flora Scotica* (1821), *Exotic Flora* (3 vols. 1823–27), and *British Flora* (2 vols. 1830–31). A genus of bulbous plants has been named *Hookera* in his honor.

**HOOKER, MOUNT**, peak (alt. 10,782 ft.) of the Rocky Mountains, SE of Mount Brown, on the boundary between British Columbia and Alberta, Canada. It was named in 1827 for Sir William Hooker, English botanist.

**HOOKE'S LAW**, a fundamental law of physics discovered by ROBERT HOOKE, determining the relationship between the amount of distortion produced in an elastic body and the force applied to produce this distortion. The technical term stress is used to describe the force per unit area; the term strain means the change of shape or volume per unit mass or volume. Using these terms, THOMAS YOUNG (1733–1829) gave a more precise meaning to Hooke's Law, by saying that stress divided by strain yields a constant, called the modulus of elasticity. This constant for any given material is valuable as a factor in engineering design, and is given in engineering handbooks. For example, aluminum has a modulus of elasticity of about 10,000,000 lbs. per sq. in., while cast steel has a modulus of about 28,000,000 lbs. per sq. in.

E. A. M.

#### **HOOKEWORM AND HOOKEWORM DISEASE.**

No parasitic worms are more injurious to the human race than hookworms; by some writers they are ranked second only to malaria as a human scourge. Hookworm disease, often called *ancylostomiasis* in medical literature, is insidious, never spectacular. Year after year, generation after generation, it saps the vitality and undermines the health and efficiency of whole communities, ultimately leading to a severe state of degradation marked by poverty, ignorance, sickness, and utter lack of ambition.

Hookworms are widely distributed in all tropical and subtropical parts of the world, wherever the soil is kept moist by rain or irrigation, and they are a menace in mines in countries far removed from the tropics. In the United States hookworm infections, especially in children, are prevalent in rural areas in the southeastern states. There has been a great reduction in the severity and incidence of infections since the campaign against hookworm initiated by the Rockefeller Foundation about 1910. At present the areas of extensive and severe hookworm infection are largely localized, and of those who are infected only about 25 per cent harbor enough worms to cause clinical symptoms.

**Description of the Parasites.** Hookworms are small, blood-sucking nematode worms that live in the intestines of man and other warm-blooded animals



(see ROUNDWORM). The various species belong to a number of genera in the family *Ancylostomidae* and affect many kinds of animals, including dogs, cats, foxes, sheep, and cattle. Two species are common intestinal parasites of man. The Old World hookworm (*Ancylostoma duodenale*) is the prevalent species around the Mediterranean, northern India, north China, and Japan. The American hookworm (*Necator americanus*) probably originated in the Old World and was brought to America from Africa in the slave days. It is now the prevalent species in tropical parts of the Old World and also throughout both North and South America and the West Indies. The two species are similar, but the Old World species is more injurious and harder to expel.

One species (*A. braziliense*) that is a common intestinal parasite in dogs and cats in many parts of the world is the usual cause of a skin infection in man called *creeping eruption*. If the minute larvae of these parasites penetrate human skin they wander aimlessly just under the surface, producing winding red lines that itch intensely. These parasites are quite common on some beaches and often infect babies playing in sand piles polluted by infected cats or dogs.

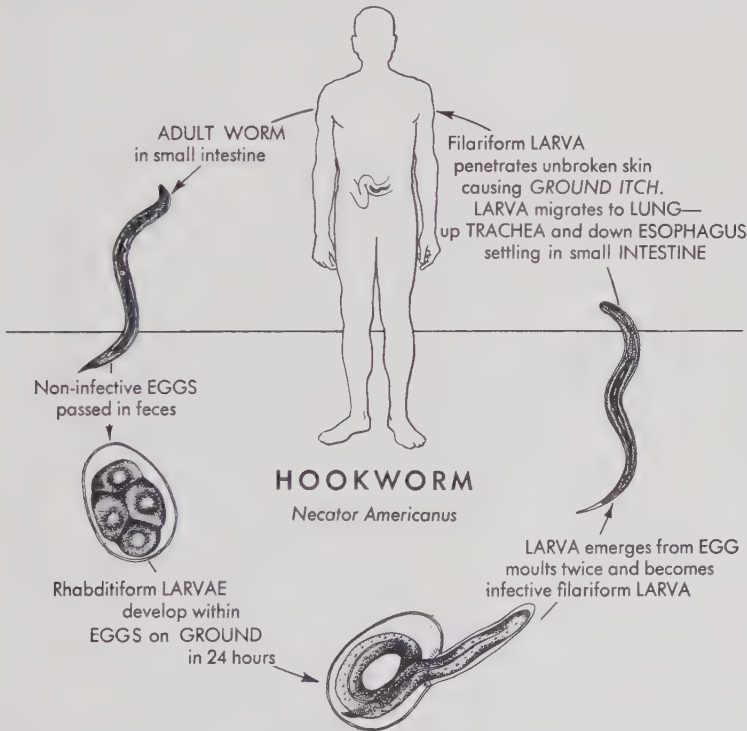
In man and other animals adult hookworms, which are from about one-third to one-half inch in length, live in the small intestine. Here they draw a bit of

first time after about two days. They molt again at about the end of the fifth day, this time retaining the shed larval skin as a sheath. They are now about half a millimeter in length and are in the infective stage. They live on or close to the surface of the soil, climbing up to vantage points on soil particles, dead vegetation, etc., as far as a film of moisture extends. When exposed to direct sunlight or drying they retreat into the upper layers of the soil. Unable to eat at this stage, they can live in the soil only as long as the food stored in their intestinal cells lasts.

The larvae do not move about much in the soil but may be dispersed by rain, insects, etc. Soon killed by exposure to direct sunlight or drying, they thrive best in loose, sandy soil that is well shaded and moist. Their development is retarded by temperatures below 70° F., and ceases below 50° F.; frosty weather is destructive to them, even after reaching the infective stage. Under natural conditions in soil few larvae survive as long as six weeks.

**Infection and Symptoms.** Although infection occasionally results from food or water contaminated by the larvae it usually comes from the larvae burrowing through the skin, most frequently of the feet. Where the larvae enter the skin an inflammation called *ground itch* or *water sore* appears. The larvae soon find their way into a lymph channel or blood

vessel, by which they reach the heart and then the lungs. Here they leave the capillaries and enter the air spaces (alveoli) of the lungs. If many larvae are acquired at one time they may injure the lungs at this stage. From the alveoli they make their way via the bronchial tubes and trachea to the throat. By now they have molted a third time and are fourth-stage larvae. The larvae that are not spit out from the mouth are swallowed and passed down to the small intestine. Here they molt for the last time and become young adult males and females. In man, eggs of the worms usually don't begin to appear in the feces until about six weeks after infection. Most of the adults probably don't live more than a year, although some may live for five years or more. In areas where many people are infected repeated reinfection is common. In the course of time some degree of immunity develops; many of the larvae fail to reach the intestine because



mucous membrane into their mouth capsules and continuously suck blood and tissue juices. The females produce eggs at the rate of 5,000 to 10,000 per day. The eggs are oval, thin-shelled, and unstained by the bile in the intestine; they measure about 60–70 by 38–40 microns. At the time of leaving the body with the feces they are in an early stage of development, consisting of only four cells. The most reliable means of diagnosing hookworm infection is the finding of these characteristic eggs in the feces.

When exposed to air in the presence of warmth and moisture the eggs deposited in the feces develop so rapidly that the embryos may hatch in less than 24 hours. Under favorable conditions at temperatures from 70°–85° F. the hatched larvae, feeding on bacteria and organic debris, grow rapidly and molt for the

they are destroyed during their migrations in the tissues. Their destruction leads to allergic symptoms, together with an increase in the kind of white blood cells called eosinophils (see BLOOD).

After reaching the intestine the worms damage their hosts mainly by sucking blood. It has been estimated that 500 hookworms may cause a loss of nearly a pint of blood a day. When the number of worms is small and the diet is rich in iron and protein (which can be used in building new blood) there are few or no obvious symptoms. But in children growth may be stunted and resistance to disease and fatigue lowered because so much nourishment is continually diverted for replacement of lost blood. When the repair cannot keep pace with the damage there is ANEMIA. Symptoms in severe cases include: pallor;

marked languor, with indisposition to work or play, popularly interpreted as laziness; flabbiness and tenderness of the muscles; breathlessness after slight exertion; enlargement and palpitation of the heart, with weak and irregular pulse; edema, making the face puffy and the abdomen "potbellied"; a fishlike stare in the eyes; reduced perspiration; irregular fever; and gastro-intestinal symptoms such as heartburn, flatulence, bowel irregularity, and abdominal discomfort. There are usually more or less marked nervous symptoms also, and often a capricious appetite leading to "dirt eating," with a craving for eating soil, chalk, feathers, etc. Children may suffer several years' retardation in physical and mental development, and puberty may be long delayed. The loss of efficiency in laborers often amounts to 25-50 per cent. In pregnancy the effects are especially severe, often leading to stillbirths, and sometimes to severe or fatal illness in the mothers.

The white race is much more susceptible, both in number of hookworms acquired and in the damage done by a given number, than are Negroes. From a given number of worms children suffer more than adults and women more than men. Mining and agriculture are the principal occupations affected by hookworm. In most parts of the world the disease is rural rather than agricultural, although in China and Japan, where human feces (night soil) are conserved and used as fertilizer, the disease is more strictly agricultural. Certain crops, because of the climates in which they grow, the shade produced by them, and exposure to infection entailed in their cultivation, are particularly associated with hookworm infections; among these are tea, coffee, cacao, bananas, sugar cane, and mulberries.

**Control and Treatment.** Prevention of hookworm infection is theoretically easy; all that is necessary is elimination of soil pollution by human beings, since no animals are important reservoirs of human hookworms. Soil pollution is, however, a very prevalent human custom in many parts of the world, and this condition can only be improved slowly by education and example. Even in the United States about 68 per cent of rural houses in the South were without privies in the early part of the present century. Although only prevention of soil pollution will give permanent relief, there are several useful adjuncts to control of hookworm infection. Mass treatment, given to whole villages or labor forces at one time, gives immediate relief. If such treatment is given at a season when immediate reinfection from larvae already in the ground is at a minimum, it may be several years before the disease again becomes a serious problem. Wearing footgear, however simple, prevents severe infections from developing; it is valuable for personal protection but is not practical for application to entire communities where shoes have never been worn. In southern United States there is a marked falling off in hookworm infections after about the 14th year of age, mainly because children begin to wear shoes at that time. Disinfection of soil or feces is difficult and of local application only. Salt can be used under certain conditions, especially in mines, and lime added to feces kills hookworms in night soil.

In recent years tetrachlorethylene,  $C_2Cl_4$ , has been the drug most extensively used in treating hookworm disease. A dose of 3-4 cc. removes 75-90 per cent of the worms, with complete cure in many cases. A laxative should be given two hours later. An alternate drug is HEXYLRESORCINOL crystoids (Caprokol) in hard gelatin capsules. This is nontoxic and is safest in cases of pregnancy or severe illness and for young children. It can be repeated at intervals of three days. This drug has the advantage of being effective against *Ascaris* as well. Administration of large doses of iron, with a diet rich in protein and vitamins, causes more rapid improvement than expulsion of the worms, and in weak, anemic individuals should

precede the use of an anthelmintic. Nutrition is always a big factor in subsequent recovery.

ASA C. CHANDLER

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**HOOLAMITE.** See CARBON MONOXIDE.

**HOOLOCK.** See GIBBON.

**HOOP SNAKE**, a large SNAKE found in southeastern United States. The hoop snake, *Farancia abacura*, generally measures about four or five feet in length and in color is a vivid vermilion and black. Its tail is equipped with a sharp spine which provides an excellent means of defense. This reptile derives its name from the erroneous belief that it takes its tail in its mouth, curves itself into a hoop, and rolls along.

**HOOPER, JOHNSON JONES**, 1815-62, American humorous writer, was born in Wilmington, N.C. He was the editor of several Alabama papers, to which he contributed humorous sketches about frontier life, featuring a backwoods rascal named Simon Suggs. Some of the tales were reprinted in the New York *Spirit of the Times*, and a collection in book form was published as *Some Adventures of Captain Simon Suggs, Late of the Tallapoosa Volunteers* (1845). He was also the author of *The Widow Rugby's Husband, A Night at the Ugly Man's and Other Tales of Alabama* (1851), and *Dog and Gun. A Few Loose Chapters on Shooting* (1856).

**HOOPESTON**, city, Illinois, Vermilion County, on the Chicago and Eastern Illinois and the Nickel Plate railroads, and state highways 1 and 9; about 100 miles S of Chicago. Located in a farming district, Hoopston has industries devoted largely to the canning and preserving of vegetables. There are also manufactures of iron, cans, and food machinery. The townsite was platted on the farm of Thomas Hoopes in 1872. Pop. (1950) 5,992.

**HOOPOE**, a genus of insectivorous birds of the family *Upupidae*, characterized by a graceful carriage, beautiful crest, and a peculiar cry, from which the name is derived. They are found in Africa, central and southern Europe, and Asia. The common hoopoe (*Upupa epops*) is about a foot long; its plumage exhibits a fine mixture of white, buff, and black; on the tawny-colored head is an enormous erectile crest, the feathers of which have a black tip beyond a narrow white bar.

**HOOSAC MOUNTAINS**, Massachusetts, Berkshire County, are a spur of the Green Mountains, running north and south. The Hoosac Tunnel, constructed between 1856 and 1873 and used by the Boston and Maine Railroad, pierces the mountains at North Adams.

**HOOSIC RIVER**, or **Hoosick**, rises in Berkshire County, Massachusetts, flows through Vermont and New York, and after a course of about 90 miles joins the Hudson River 15 miles N of Troy.

**HOOSIER STATE**, popular name for Indiana.

**HOOTON, EARNEST ALBERT**, 1887-1954, American anthropologist, was born in Clemansville, Wis., and studied at Lawrence College, the University of Wisconsin, and Oxford University, as a Rhodes Scholar. Starting to teach anthropology at Harvard University in 1913, he became a professor in 1930; from 1914 he was curator of the Peabody Museum. He made extensive studies of the ancient Canary islanders, the New Mexican Indians, and of criminals in Massachusetts. Hooton believed that social and political strife in the world was due to the biological deterioration of man. He is a fellow of the American Association for the Advancement of Science, and wrote: *Up From the Ape* (1931); *Apes, Men and Morons* (1937); *Twilight of Man* (1939); *Why Men Behave Like Apes and Vice Versa* (1940); *Young Man, You Are Normal* (1945).





HARRIS & EWING

## HERBERT CLARK HOOVER

31st President of the United States

1929—1933

**HOOVER, HERBERT CLARK**, 1874—, 31st president of the United States, was born on Aug. 10, 1874, in West Branch, Iowa. His parents, Quakers of pre-Revolutionary American ancestry, died during his early youth. Quaker kinsmen raised the boy, first on an Iowa farm, then in Newberg, Ore., where he attended a Quaker academy; he finally completed his education as a mining engineer at Stanford University. His engineering and executive abilities soon brought him recognition and considerable wealth in positions all over the globe.

World War I found Hoover in London, where Ambassador Walter Hines Page depended upon his aid in enabling some 150,000 stranded Americans in Europe to return home. Page endorsed Hoover so warmly to President Wilson that the engineer was chosen chairman of the vital Commission for Relief in Belgium; in this capacity he gained world-wide fame by saving hundreds of thousands of Belgians and French from starvation during 1915–17. Thereafter, when the United States entered the war, Hoover was chosen to fight the battle of food as food administrator. Preferring persuasion to government coercion, he relied largely on the co-operation of housewives and a voluntary staff, popularizing the “gospel of the clean plate,” urging wheatless and meatless days of the week, and in other ways conserving food for victory without resorting to rationing for consumers.

No sooner had the war ended than Hoover was drafted to feed starving Europe. He served as an economic expert at the Paris Peace Conference of 1919 and supported the League of Nations. In 1920, after declaring himself a Republican, he had considerable support for the presidential nomination; after the Chicago convention he supported Harding, the nominee.

As secretary of commerce under both Harding and Coolidge, Hoover called upon businessmen to act upon an enlightened self-interest and to save millions by standardizing the size and shape of factory goods and by reducing large inventories in excess of demand. During the depression of 1920–21, he arranged a Federal conference on unemployment and vainly argued that the demand for labor be stabilized by large-scale public works delayed during times of prosperity. He worked to promote the vital St. Lawrence Waterway and the magnificent Hoover Dam, directed the relief work during the great Mississippi flood of 1927, and protected the principles of free speech by applying Federal regulation to the infant radio broadcasting industry.

When President Coolidge declared in 1928 that he did not “choose to run” for re-election, the Republicans nominated Hoover on the first ballot at Kansas City. Optimistically, Hoover declared that

the end of poverty was in sight and that the true issue was between “the American system of rugged individualism” and the paternalistic ideas of his Democratic opponent, ALFRED E. SMITH of New York. During the campaign, rural Democrats, especially in the South, rebelled against Smith’s Catholic, anti-prohibition, and urban background; this insured Hoover’s almost unprecedented victory of 444 to 87 and even cut into the border states with a popular vote of 21,943,000 to Smith’s 15,430,000.

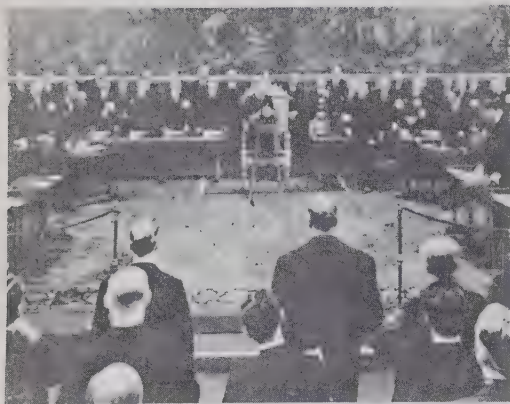
President Hoover, champion of the idea of the expert in government, created the Wickersham Commission of eminent lawyers to study the problem of law enforcement, especially of Federal PROHIBITION, and pushed through the Agricultural Marketing Act of 1929 to help the farmer dispose of his surpluses without resorting to price-fixing. When the world depression of 1929 broke out, Hoover remained true to his lifelong philosophy and called for co-operation between capital and labor to maintain wages and employment. “Economic depressions,” he told Congress in December, 1930, “cannot be cured by legislative action or executive pronouncement.” Republican protectionists in Congress, with only mild resistance from Hoover, chose this opportunity to pass the prohibitive Hawley-Smoot Tariff Act of 1930, which led to foreign retaliation against American goods.

A march of unemployed veterans on Washington—the so-called Bonus Expeditionary Force—ended in a clash with Federal troops under Douglas MacArthur. Successive bank and industrial failures compelled the president to establish a super-credit agency, the RECONSTRUCTION FINANCE CORPORATION, in January, 1932. Although convinced that relief belonged to the localities rather than Washington, he used the RFC to rescue needy private enterprises and local relief agencies and to lend up to \$1,500,000,000 for public construction projects of a self-liquidating nature.

Hoover supported the Norris-LaGuardia Anti-Injunction Act of March, 1932, which strengthened collective bargaining by discouraging Federal injunctions in labor disputes and employer intimidation of prospective union members (the yellow dog contract). But another Norris Bill, one dealing with Federal operation of Muscle Shoals in the interest of cheap electrical power—the forerunner of TVA—was vetoed by Hoover as hostile to free enterprise.

Hoover’s foreign policies faced a critical world situation. After German and Austrian bankruptcies forced England off the gold standard and made impossible the payment of reparations and inter-allied war debts. Hoover promptly arranged a year’s MORATORIUM on all intergovernmental debts. In his efforts for peace, he tried vainly to cut existing armaments by one-third in the World Economic Conference of

It happened when  
**Herbert Hoover**  
 was president . . .



P AND A PHOTOS  
**Naval Limitation Conference at London in 1930** sought to settle cruiser strength of great powers



INTERNATIONAL NEWS  
**Stock Market Crash** occurred on Oct. 29, 1929. This is a scene in Wall Street on day of the crash



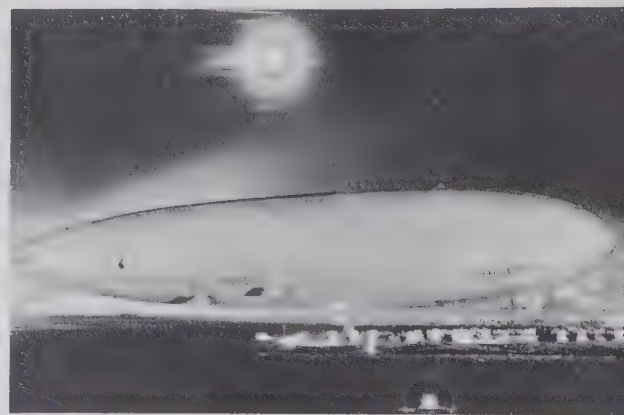
ACME  
**Reconstruction Finance Corporation** was established in 1932. The first members of the board were Bestor, Mills, Couch, Jones, Dawes, and Meyer



PAUL'S PHOTOS  
**Amelia Earhart** was leading figure at air races in France



ACME  
**Bonus Expeditionary Force** march on Washington in 1932 was dispersed by army tanks and gas bombs



UNDERWOOD AND UNDERWOOD  
**Graf Zeppelin** moored at Los Angeles before final leg of its flight around the world in August, 1929



## Hoover

February, 1932, but Japan's aggression in China ended the matter. His secretary of state, HENRY STIMSON, co-operated with the League short of actual membership and in the Stimson Doctrine of Jan. 7, 1932, warned Japan that we would not recognize any arbitrary changes made in violation of existing international agreements. In Latin-America Hoover as president-elect coined the term "Good Neighbors."

In 1932, Hoover was renominated without serious challenge. He reaffirmed his opposition to the "collectivist" experiments proposed in the New Deal of his opponent, Franklin D. Roosevelt. To a large extent, the great depression, with its 14,000,000 unemployed and catastrophic bank and industrial failures, determined the result. Hoover suffered one of the worst defeats in presidential history, retaining only 59 electoral votes to Roosevelt's 472, although taking 15,761,787 of the popular vote to his opponent's 22,821,513. Between election day and the inauguration, Hoover endured the lot of a repudiated statesman with little effective control over the final bank smash, which was to end in the closing of practically every bank in the country on Mar. 4, 1933.

In the succeeding years, Hoover was an active elder statesman of his party, assailing the New Deal vigorously and, while critical of the international Fascist menace, decrying the administration policy of aiding the Allies "short of war." In the years following World War II he was an active adviser on the gigantic problem of relief and reconstruction abroad, and urged the recovery of Germany as the first necessity to the recovery of Europe. In 1947, President Truman called on him to head a commission to study the antiquated structure of the executive branch of the Federal government and to recommend reorganization. See UNITED STATES, Government.

In the critical times which came with the struggle between Communist armies and those of the United Nations in Korea, Hoover advanced his highly controversial "American Gibraltar" plan. In 1950-51 he advocated limiting U.S. defenses to the Western Hemisphere, to Japan, Formosa, and the Philippines in the Pacific, and to Great Britain in the Atlantic. This view was labeled "isolationist" by many.

Among Hoover's writings are *Principles of Mining* (1909); a translation of Agricola's *De Re Metallica* (1912); *American Individualism* (1922); *Addresses upon the American Road 1933-1938* (1938); *Further Addresses upon the American Road* (1940).

Hoover's birthplace, in West Branch, Ia., became a public memorial.

HARVEY WISH

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**HOOVER, JOHN EDGAR, 1895–**, American lawyer and criminologist, was born in Washington, D.C., and studied law at George Washington University. Active in counterespionage during World War I, he became director of the General Intelligence Division (1919), assistant director (1921), and director (1924) of the FEDERAL BUREAU OF INVESTIGATION. Under his leadership, the FBI gained prestige, authority, and scope and effectiveness of operations, becoming one of the world's best law-enforcement agencies. Hoover wrote numerous articles in popular magazines, law reviews, and police journals, and made speeches exposing



FROM "FACES OF DESTINY,"  
BY YOUSUF KARSH (ZIFF-DAVIS)

J. E. Hoover



UNITED AIR LINES

Aerial view of Hoover Dam and Lake Mead

seditionists, saboteurs, and gangsters. His best-known book is *Persons in Hiding* (1938).

**HOOVER DAM, or BOULDER DAM**, a great irrigation and hydroelectric dam built and owned by the United States government, at Black or Boulder Canyon of the Colorado River where it forms the boundary between Arizona and Nevada. The dam serves three principal purposes: storage of water for irrigation of the rich but arid lands of the Southwest, generation of hydroelectric power, and flood control. The dam is one of the largest in the world, and is the highest from base to crest, rising 726 feet above bedrock. It is 1,244 feet long at the top, where it has a thickness of 45 feet, and contains 4,400,000 cubic yards of concrete. The water impounded by the dam forms Lake Mead, the largest artificial lake in the world, 115 miles long and 8 miles in maximum width, with a capacity of 30,500,000 acre-feet of water. The project was begun in 1930 and completed in 1936. The dam was named "Hoover Dam" in 1930; this was changed to "Boulder Dam" in 1933 by Secretary of the Interior Ickes. The original name was restored in 1947 by a Congressional resolution. See DAM.

**HOOVER LIBRARY ON WAR, REVOLUTION, AND PEACE**, located at Stanford University, Palo Alto, Calif. The library was begun in 1914 by Herbert Hoover and is considered the most important research collection in the world on World Wars I and II. The \$600,000 building, made available by various foundations and individual donors, was opened in 1941 and contains about 120,000 volumes, large collections of pamphlets, documents, leaflets, posters, maps, photographs, moving picture films, newspapers, manuscripts, and objects of art. First known as the Hoover War Collection, it later became the Hoover War Library; as its scope expanded it assumed its present title. It now covers political philosophy and world peace plans as well.

MILDRED PETERSON

**HOP**, a climbing herb native to north temperate regions and extensively cultivated in the United States, England, and Germany. The common hop, *Humulus lupulus*, belongs to the Mulberry family, *Moraceae*. It is characterized by heart-shaped leaves that are covered with yellow, resinous grains. These grains give a characteristic bitter taste and aroma to the plant. The twining stem of the hop is prickly and bears dioecious flowers with female blossoms appearing in scaly glandular catkins. Wild hops usually grow in waste places, while the cultivated species are grown

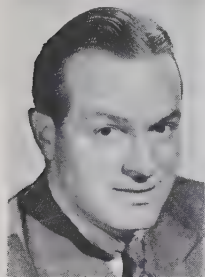


on trellis-like structures. Harvesting occurs in fall and consists of gathering and drying the female catkins. The dried inflorescence contains a resin and a group of narcotic principles that are used in medicine for their sedative properties. The chief use of hops, however, is in the brewing industry, where they are used to flavor beer. See BREWING.

**HOPCALITE.** See CARBON MONOXIDE; GAS MASK.

**HOPE, ANTHONY**, pseudonym of Sir Anthony Hope Hawkins, 1863-1933, English novelist who was born in London and educated at Oxford. He studied law and was admitted to the bar but soon gave it up for literature. He published *A Man of Mark* in 1890, and in 1894 appeared his two great successes, *The Prisoner of Zenda* and *The Dolly Dialogues*, examples of widely different styles. He was knighted in 1918.

**HOPE, BOB**, real name Leslie Townes Hope, 1903-



PARAMOUNT

Bob Hope

was born in Eltham, Kent, England, and came to the United States in 1907. He played the vaudeville circuits and appeared in *Ballyhoo* of 1932 and *Roberta* (1933). Hope started his radio career in 1935. A master of the "gag line," he featured in his programs his swift flow of patter and a coterie of "zany" characters. He was a motion picture actor after 1938, starring in such comedies as *The Cat and the Canary* (1939), *The Road to Zanzibar* (1941), and in 1950 he began television broadcasts.

Hope was much praised for his entertainments of troops during World War II and the Korean war.

**HOPE**, town, SW Arkansas, county seat of Hempstead County; on the Missouri Pacific, the Louisiana and Arkansas, and the Frisco railroads and U.S. Highway 67, about 25 miles NE of Texarkana in a truck-farming region. In 1938 the inhabitants were victorious in their 60-year effort to make Hope the governmental center of Hempstead County. The town is an important commercial center and the shipping point for watermelons, cantaloupes, and potatoes grown near by. It has sawmills and brick plants and manufactures insecticides and wood products. Pop. (1950) 8,605.

**HOPE COLLEGE.** See COLLEGES.

**HOPEDALE**, town, Massachusetts, Worcester County, on the Grafton and Upton Railroad, about 34 miles SW of Boston. Originally a part of Milford, Hopedale was founded in 1841 by Rev. Adin Ballou, a Universalist clergyman, to be "an experiment in the science of a divine order of society, or an attempt to actualize in organic form the kingdom of God on the earth." Hopedale community was a joint-stock company with features of both communism and individualism; besides the farm of 238 acres it had industries to make breadstuffs and clothing for the members. By 1854 the community had about 200 members. The project, however, proved an economic failure; hence it had to be discontinued in 1856, but certain features of communism were continued until about 1862. Hopedale was incorporated in 1886. Pop. (1950) 3,479.

**HOPEH**, or **HOPEI**, also Chihli, or Pechihli northeasternmost of the 18 provinces of China proper, in E central Asia; bounded on the N by Inner Mongolia (Jehol and Chahar), from which it is separated by the Great Wall; on the E by the Gulf of Chihli (Pechihli), or Pohai, an arm of the Yellow Sea, and Shantung Province; S by Honan Province; and W by Shansi Province; area about 54,000 sq. mi.; pop. (1947 est.) 28,644,000. The chief cities are PEIPING (Peking) pop. (1947 est.) 1,602,234; TIENTSIN (1,679,210), leading port and industrial center of N China; and TSINGYUAN (Paoting), the capital (408,000).



EWING GALLOWAY-DEANE DICKSON

Sidewalk baker displays his wares in Peiping

Most of Hopeh is part of the great alluvial, treeless plain of northern China, with a low range of mountains along the northern and western boundaries. Through it flows the system of the Peiho and other rivers that empties into the Gulf of Chihli at Tientsin and Taku; flood waters from these rivers sometimes inundate the country between Tientsin and Peiping. Also the Luan (Lwan) River, flowing from Inner Mongolia to the gulf, cuts across the northeast corner of the province. Hopeh has a typical north temperate continental climate, dry and quite cold in winter and somewhat rainy and hot in summer, with fine weather in spring and autumn. A feature of the atmosphere is the dust the winds bring from the Gobi Desert, 600 miles to the northwest, and sometimes stir up from the light soil of the province.

In 1914 the northern part of the old Chihli (metropolitan or direct rule) Province, as it had been under the Manchus, was transferred to Inner Mongolia. The Kuomintang government, disliking the political connotation of the historic name, changed it to Hopeh (Hopei), meaning north of the Hwang (or Yellow) River; they also changed the name of Peking (northern capital) back to the Peiping (northern place) of the early Mings (14th century). In 1949 the Communist government restored the name of Peking.

**Economic Life.** The chief agricultural products of this fertile province are kaoliang (a kind of corn or sorghum), millet, and wheat; others are barley, buckwheat, beans, peanuts, cotton, and persimmons, apples, and numerous other fruits. The farmers possess an unusually large number of horses, donkeys, and mules. The Kailan mines, one of the important coal centers of Asia, under British management, are near the port of Chinwangtao. The great river port of Tientsin is the main manufacturing district; one of the products, Tientsin rugs, is world famed. Jute, hog bristles, and Chahar wool are important in Hopeh trade. And through Hopeh went the famous brick tea to Russia.

Freight train on the Peiping-Hankow trunk line

EWING GALLOWAY-BURTON HOLMES





Its railroads make Hopeh one of the best served provinces in China: the Peiping-Hankow trunk line connects with central China, north to south, including the cities of Kaifeng, Sian, Hankow, Wuchang, Changsha, Kweilin, Canton, and Hong Kong; the Peiping-Tientsin-Mukden line connects with the railroads of Manchuria and Korea; the Tientsin-Pukow trunk line connects with Tsinan, Tsingtao, Nanking, and Shanghai; the Peiping-Kalgan line connects with Chahar and Suiyuan; and a new railroad crosses the Great Wall into Jehol. From Hopeh the ancient caravan highways still stretch to the Mongolias and the vast western interior of China; junks still ply the 13th-century Grand Canal from Tientsin south through the plain to the Yangtze Kiang.

**History.** The densely populated region now known as Hopeh is the most historic in China. It has been an integral, vital part of a nation that has been in continuous existence for at least 40 centuries, the oldest living nation. In it is the oldest active great capital city site, Peking, to which the Communist regime restored its five-century-old name; Peking, most famed city in China and one of the most marvelous in the world. For over 30 centuries cities have been built and rebuilt, named and renamed, on this site. The Hopeh region is one of the oldest habitation areas on earth, as evidenced by one of the most valuable ethnological discoveries yet made, that of Pleistocene Peking Man, in a cave north of Peking. Situated at the meeting of the vast regions of the Han Chinese of the south, the Manchu and cognate peoples of the northeast, and the Mongol nations of the northwest, it has been on the uneasy border line between these virile races. It has been the place of ingress and the seat of dominion of the strong peoples of the north, who for ages ruled all or part of China. See *SINANTHROPUS PEKINENSIS*.

In remote times the Hopeh region was a buffer between the resilient Chinese and the ravaging Hiungnu (Hsiungnu) nomads (Huns) of the northern steppes. Called Yen in the 12th century B.C., it stood guard through centuries against the irruptions of these tribes; in those times the capital site was named Chi. The Great Wall, passing some 35 miles north of Peking, was built in the third century B.C. by the great Emperor Tsin Chi Hwangti (Chin Shih Huangti) to keep out the fierce northerners. Nevertheless, they managed to invade and hold the Hopeh region for long periods. In the 10th century began the successive invasions of real conquerors: the Khitans (Iron Dynasty), Kins (Golden Dynasty), Mongols, and Manchus. They all founded empires, comprising China, or part of it, and their own and other domains from north to west, with the Hopeh region as the pivot province, and they all established their capitals on the Peking site. Under the Mongols and Manchus China became, at times, the greatest of nations. In the days of Kublai Khan (13th century), first Mongol emperor, whose capital was the fabulous Khan-balik (City of the Khan), Hopeh was the center of one of the largest empires the world has known. Between the Mongol and Manchu dynasties was that of the Chinese Mings, whose seat, in the 15th to 17th centuries, also was in the Hopeh Province; they named the capital site Peking, which it remained until 1928, when the Kuomintang renamed it Peiping. The name Peking was restored in 1949.

Modern invasions of the province included those by an Anglo-French expedition which in 1860 forced its way from Tientsin to Peking, where the British burned the famed Yuen Min Yuen (imperial summer palace) and obtained new treaties from the Chinese; a force of Americans, Europeans, and Japanese who marched from Tientsin to Peking in 1900 to lift the Boxers' siege of the foreign legation community; the army of Chang Tso-lin, bandit leader, who, with his son Chang Hsueh-liang, ruled Manchuria between the downfall of the Manchus in Peking and its seizure by the Japanese in 1931; and, last and most impor-



E. PAINE

Stairways in a section of Great Wall of China

tant, by the Japanese, who held the province for a decade (1937-45). The first shot of the second Japan-China war, fated to merge into World War II, was fired in a grove in the Lukochiao district south of Peiping, July 7, 1937. The Kuomintang government occupied Hopeh after Japan's defeat in 1945. In the civil war which followed, the Manchurian Communist army overran Hopeh in late 1948. Peiping fell to the Communist forces on Jan. 22, 1949; in September, under the name of Peking, it was proclaimed capital of the People's Republic of China.

**HOPEWELL**, city, E central Virginia, Prince George County, near the confluence of the James and the Appomattox rivers; served by the Norfolk and Western and the Seaboard Air Line railroads and river and ocean-going vessels, about 18 miles S of Richmond. One of Virginia's youngest cities, Hopewell is built on the site of one of Virginia's oldest settlements, City Point, founded in 1611. The area was the scene of Indian warfare and naval and military maneuvers during the Revolutionary and Civil wars. Incorporated in 1916, Hopewell grew up about a World War I munitions plant which rocketed the city's population to 40,000 for a time. One of the historic landmarks within the city is Cawsons, the birthplace of John Randolph of Roanoke. Hopewell's manufactures include rayon yarn, paper, boxwood, cellulose, and wood products. Pop. (1950) 10,219.

**HOPEWELL VILLAGE NATIONAL HISTORIC SITE**, SE Pennsylvania, Berks County, six miles SE of Birdsboro. The site includes the ruins of an iron-making village containing industrial struc-

The Hopewell Village National Historic Site

NATIONAL PARK SERVICE



tures and picturesque homes erected on French Creek in 1770–71. The village was operated as a semifeudal community built around an iron furnace which was used until 1883. The site, containing 6,197 acres, was established in 1938.

**HOPÍ INDIANS**, a group of pueblo or town-building Indians living in Arizona near the New Mexico line. The ancestors of these Indians were in the same general locality in 1541 when Coronado visited the area. To a surprising extent they still preserve their old dress, customs, and beliefs despite long-continued contact with the Spanish and Americans. There are seven main pueblos situated on the tops of high cliffs rising out of the desert sands. In this semiarid land the Hopi's raise crops of corn, beans, and squash by means of dry agriculture. Their great dependence on rain is reflected in their religious practices which are characterized by a great amount of symbolism and ritual associated with fraternities or semisecret societies. They have a clan system of relationships and obligations and a well organized village government.



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**Hopi Indians**

The inhabitants of six of the seven Hopi towns speak Shoshone—a division of the Uto-Aztec language. It appears that a people closely related to the Ute drifted into the southwest many centuries ago and there took part in the development of the Cliff Dweller-Pueblo culture or borrowed its essentials from the people already there. See **PUEBLO INDIANS**.

FAY-COOPER COLE

**HOPKINS, EDWARD**, 1600–1657, governor of Connecticut in alternate years from 1640 to 1652, was born in England. He went to Boston in 1637, and later settled in Hartford. The union of the New England colonies (1643) was largely due to him, and he left a part of his estate (about \$5,000) to the grammar schools of Hartford, New Haven, and Hadley.

**HOPKINS, ESEK**, 1718–1802, first commander in chief of the American Continental Navy, was born in Scituate, R.I., and became a merchant captain commanding a privateer during the Seven Years' War. In October, 1775, he was put in charge of Rhode Island's military forces, and in December the Continental Congress appointed him commander in chief of the new navy. For changing an order in 1776, he received a vote of censure from Congress. Failing to keep his small navy together, in the face of difficulties similar to those which confronted Washington, he was dismissed from service in January, 1778. He was deputy to Rhode Island's assembly from 1777 to 1786.

**HOPKINS, Sir FREDERICK GOWLAND**, 1861–1947, British biochemist, was born in Eastbourne, Sussex, and studied at the University of London. After 1914 he was professor of biochemistry at the University of Cambridge and from 1921 to 1943 held the Sir William Dunn chair. The principal discoveries made by Hopkins were devising a new method of estimating the amount of uric acid in urine (1892), analyzing the crystalline amino acid known as tryptophan (1901), and isolating glutathione, an amino acid combination important in cell auto-oxidation (1921). Between 1906 and 1912 he conducted experiments with rats which proved that certain "accessory factors" (now known as vitamins) are necessary to sustain life and included milk (which contains vitamins A, D, and G) among the protective foods. Hopkins was president of the Royal Society (1930–35) and of the British Association for the Advancement of Science (1933).

He shared with **CHRISTIAAN EIJKMAN** the 1929 Nobel prize in physiology and medicine.

**HOPKINS, GERARD MANLEY**, 1844–89, English poet, was educated at Oxford, where he was a student of Jowett and Pater. He was converted to Catholicism in 1866, became a member of the Jesuit order, and was ordained in 1877. After a period of parish work he was sent to Dublin, where he taught Greek at University College. His poems first appeared in a posthumous collection edited by his friend Robert Bridges for Miles' *Poets and Poetry of the Century* (1893). His metric innovations, which he called "sprung rhythm" and "outrides," and the startling sensuous imagery which he used to illustrate his religious themes had a belated but powerful influence on modern poetry. A relatively complete edition of the poems was published by Bridges in 1918 (revised with additional poems by Charles Williams, 1930).

BIBLIOG.—E. Ruggles, *Gerard Manley Hopkins* (1944); The Kenyon Critics, *Gerard Manley Hopkins* (1946).

**HOPKINS, HARRY LLOYD**, 1893–1946, American administrator, was born in Sioux City, Iowa, and studied at Grinnell College. While head of the New York Tuberculosis Association, he was appointed relief administrator (1931) by Governor Roosevelt. After Roosevelt became president, Hopkins directed the Federal Emergency Relief Act (1933–38), the Civil Works Administration (1933–34), and the Works Progress Administration (1935–38). After serving as secretary of commerce (1938–40), he assisted Roosevelt in mapping out Lend Lease and became its administrator (1941).

In World War II Hopkins was a member of the War Production Board, the Office of War Mobilization, and the central committee of the American Red Cross, and was chairman of the Munitions Assignments Board. He traveled all over the world on various diplomatic missions as personal envoy of the President and attended all major war conferences except one, although ill most of the time. Resigning from his post (1945), he became impartial chairman of the New York Cloak and Suit Industry from September 1945, until his death. Robert E. Sherwood edited the *White House Papers of Harry L. Hopkins* (1949).

**HOPKINS, JOHNS**, 1795–1873, American financier and philanthropist, was born in Anne Arundel County, Md. At 17 he went to Baltimore and learned the wholesale grocer's business in his uncle's firm. In 1819 he started in business for himself and in 1822 formed the company, Hopkins Brothers. In 1847 he became director and in 1855 chairman of the finance committee of the Baltimore and Ohio Railroad and saw it through the panics of 1857 and 1873. He left \$7,000,000 to found Johns Hopkins University and Johns Hopkins Hospital in Baltimore.

**HOPKINS, MARK**, 1802–87, American educator and theologian, was born in Stockbridge, Mass., and studied at Williams College and Berkshire Medical College. He was professor of moral philosophy and rhetoric at Williams College from 1830, and its president from 1836 to 1872. Ordained a Congregational minister in 1836, he presided over the American Board of Commissioners for Foreign Missions (1857–87). He published several books of sermons and lectures, and *Miscellaneous Essays* (1847), *Strength and Beauty* (1874), and *Teachings and Counsel* (1884). In the educational field Hopkins was famed as a user of the Socratic method; President Garfield once said that his ideal of a college would be a log in the forest with a student at one end and Mark Hopkins at the other.

**HOPKINS, SAMUEL**, 1721–1803, American theologian, was born in Waterbury, Conn. A follower of Jonathan Edwards, he held pastorates in Housatonic (Great Barrington), Mass., and in Newport, R.I. He was the founder of "Hopkinsian divinity," a modification of Calvinism, and was a leading opponent of slavery and the slave trade. His outstanding work was *System of Doctrines* (2 vols. 1793).



**HOPKINS, STEPHEN**, 1707–85, colonial governor of Rhode Island, and a signer of the Declaration of Independence, was born in Providence, where he became a merchant and shipbuilder. He was a member of the colonial assembly in 1732–41; chief justice of the Superior Court in 1751–54; delegate to the Colonial Congress which assembled in Albany in 1754; and nine times governor of Rhode Island. In 1774–78 he was delegate to the Continental Congress. In 1764 he prepared a pamphlet, *The Rights of Colonies Examined*, which the assembly ordered to be printed, and in 1774 he drew up a bill to prohibit the slave trade. He wrote *A True Representation of the Plan Formed at Albany for Uniting All the British North American Colonies* (1755), and *An Historical Account of the Planting and Growth of Providence*, the remaining fragment of which was published by the Massachusetts Historical Society (1822).

**HOPKINS**, village, E Minnesota, in Hennepin County, a SW suburb of Minneapolis, is located in a truck farming area. The manufacture of agricultural equipment is the chief industry.

**HOPKINSON, FRANCIS**, 1737–91, American author, composer, and legislator, was born in Philadelphia and was educated at the College of Philadelphia, of which he was the first graduate. He was admitted to the bar in 1761, practiced successfully in New Jersey and Pennsylvania, and in 1774 received an appointment to the New Jersey governor's council. He soon lost his post, however, for his presentation of the colonists' grievances in *A Pretty Story* (1774), and other political satires. He was a delegate from New Jersey to the Continental Congress and was one of the signers of the Declaration of Independence. During the Revolutionary War he served on the Continental Navy Board (1776–78) and in the admiralty court of Pennsylvania (1779–89), and continued to publish boisterous anti-British satires, notably "The Battle of the Kegs" (1778), a comic ballad. Hopkinson was also a talented artist and musician. He designed the original Stars and Stripes, many coins and seals, and was the first native American composer. His musical compositions include *Alfred*, a *Masque* (1757); *The Temple of Minerva* (1781), a cantata; and *Seven Songs for the Harpsichord or Forte-Piano* (1788).

**HOPKINSON, JOSEPH**, 1770–1842, American jurist, son of FRANCIS HOPKINSON, born in Philadelphia. He was counsel for Dr. Benjamin Rush (1799) against William Cobbett, and for Judge Samuel Chase (1804–05), when impeached before the Senate. He was a representative in Congress (1815–19), and was a judge of the United States District Court for Easton, Pa. (1828–42). He was author of the national song "Hail Columbia" (1798).

**HOPKINSVILLE**, city, SW Kentucky, county seat of Christian County; on the Illinois Central, the Louisville and Nashville, and the Tennessee Central railroads and U.S. highways 41 and 68, about 70 miles N of Nashville, Tenn., in a rich tobacco-growing area. Founded in 1797 on land given by Bartholomew Wood, the settlement was incorporated in 1804 and later renamed to honor Gen. Samuel Hopkins, a leader in the War of 1812. Hopkinsville is the seat of Bethel Women's Junior College (1854). It has many buildings of the pre-Civil War period. The city is an important dark-fire tobacco market. There are gas wells and coal mines nearby. Pop. (1950) 12,526.

**HOPPE, WILLIAM FREDERICK**, known as Willie, or the Boy Wonder, 1887–, American billiard player, was born in Cornwall, N.Y. Considered the greatest billiard player of all time, he was world's 18.2 balkline champion (1907, 1910–20, 1923–24); 18.1 balkline champion (1906–07, 1909–11, 1914–26, 1927–), and three-cushion champion (1936, 1940–44, 1947–52). He retired from active competition in October 1952.

**HOPPER, DEWOLF**, full name William De-Wolf, 1858–1935, American singer and comedian, was born in New York City. After his first professional

appearance in *Our Boys* (1878), he joined Daniel Frohman's Madison Square company and later became a musical comedy star. Although he was a member of the Weber and Fields troupe for some time, he gained his most important successes in Gilbert and Sullivan operas. He played his most popular role in *The Mikado* for the first time in 1913 and from 1921 to 1925 headed his own Gilbert and Sullivan company. His recitations of "Casey at the Bat" were famous during his lifetime. His book, *Once a Clown Always a Clown* (1927), was written in collaboration with W. W. Stout.

**HOPPNER, JOHN**, 1758–1810, English portrait painter, was born in Whitechapel, London. Appointed portrait painter to the prince regent, he became the most popular society painter in London, sharing honors with Sir Thomas Lawrence. In a style influenced by Reynolds, but softer and more feminine, he painted the Countess of Oxford, Princess Sophia, and William Pitt. Although rich and successful, he verged on the brink of madness during his later years and died almost insane.

**HOQUIAM**, city, Washington, Grays Harbor County, 75 miles WSW of Tacoma, at the mouth of the Hoquiam River on Grays Harbor 14 miles from the ocean, and on the Northern Pacific, the Union Pacific, and the Milwaukee railroads, steamship lines, and U.S. Highway 101; adjoining Aberdeen. Sheltered on the north by great timber areas, the city is largely dependent on lumbering and the manufacture of paper and pulp, furniture, and other wood products. There are extensive loading docks for shipping lumber and facilities for handling salmon, pilchards, tuna, oysters, and clams. Hoquiam commands a fine view of Mount Rainier and the Olympic Range. The town was settled in 1886 and incorporated in 1890. Pop. (1950) 11,123.

**HOR**, or **Jebel Harun**, "Aarons Mount," mountain of Trans-Jordan on the border of the land of Edom (Num. 20:23), between the Dead Sea and the Gulf of Aqaba. It is the reputed scene of Aaron's death, and the structure on the summit is said to mark his tomb.

**HORACE**, in full **Quintus Horatius Flaccus**, 65–8 B.C., Roman poet, was born near Venusia in Apulia. He was not of Roman blood, but was educated in Rome and in Athens. In 44 B.C., when Brutus visited Athens after the murder of Caesar, Horace joined him as military tribune, and took part in the decisive battle of Philippi (42 B.C.). He soon afterward returned to Rome, and secured a place as clerk in the quaestor's office. Before long Virgil and Varius brought him to the notice of Maecenas (38 or 37 B.C.), who presented him with an estate in the Sabine country. Through Maecenas he enjoyed the best society of the time, including that of Augustus. See **LATIN LITERATURE**.

**Works.** Horace's writings include four books of *Odes*, lyrical poems on a variety of subjects; one book of *Epodes*—he called them iambics, i.e., lampoons of a bitter and sometimes coarse description; two books of *Satires*, which, on the whole, are not violent or severe, but rather caustic and witty sketches of the character and manners of the times; two books of *Epistles*, which are similar to the *Satires*, but wider in their choice of subjects, and even more good-humored in their tone; and the *Ars Poetica*, a letter to a young friend, dissuading him from attempting poetry, while giving advice on the subject. For the varying theories as to the precise dates of publication of his works any of the authorities mentioned below may be consulted. As a lyric poet he charms us more by the unsurpassable perfection of his language and his absolute command of metrical expression than by the fervor, the passion, and the inspiration that infuse the greatest lyrical poetry. His love poems are scarcely more than graceful society verses; his reflections on life, death, and such graver subjects are mostly commonplace; it is chiefly in his celebrations of Roman conquests and

character that we find in him a genuine feeling and force, though in his many pleasing descriptions of nature also there is much real poetry. There is also another charm, which even more conspicuously recommends the *Satires* and *Epistles* to readers, and that is the candor of the poet's self-revelation. He shows himself genial, courteous, considerate, compassionate of error, while severe against dishonesty of every sort, and of a genuine independence of mind; and his insight into the essentials of human nature was such that even today no poetry applies so readily to all sorts of social circumstances as that of Horace. Many a Horatian phrase is proverbial.

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**HORAE**, the Seasons, in ancient Greek mythology, were daughters of Zeus and Themis, goddesses who regulated the order of nature, guarded the doors of heaven, and promoted the fertility of the earth by their control of the weather. This number is usually given as three or four. They are represented in art as maidens in the bloom of youth.

**HORATII**, three brothers of the Horatian clan in ancient Rome, who fought with three Curiatii from Alba to decide whether Rome or Alba should rule the Latin league.

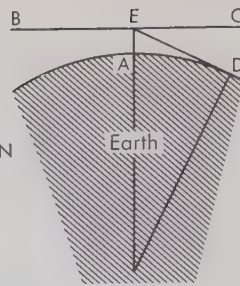
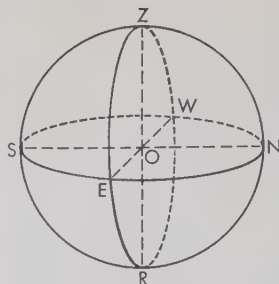
**HORATIUS COCLES**, on the occasion of PORSENA's attack on Rome, about 508 B.C., is said to have held (with two others) the Sublician bridge against the whole Etruscan army, while the bridge was being broken down. He then sprang into the Tiber, and swam ashore. The story may be found in one of Macaulay's *Lays of Ancient Rome*.

**HORDALAND**, county, SW Norway, bounded on the W by the North Sea, N by the county of Sogn og Fjordane, E by Buskerud and Telemark counties, and S by Rogaland; area 6,043 sq. mi.; pop. (1946) 188,389. The coast is studded with islands and deeply indented. Hardanger Fjord penetrates inland for a distance of 70 miles. From the low coast the land rises toward the east to the Hardanger Fjeld, ranging in altitude from 2,000 to 5,000 feet. The lower slopes are forested with deciduous trees and conifers, furnishing fuel and timber products. In the valleys and along the coast the soil is fertile. Grains, forage crops, and potatoes are raised, and fruit is grown in sheltered coastal regions. Dairying and livestock raising are important, and fishing is a thriving industry. The region is popular with tourists. The chief city is BERGEN.

**HORDEIN**, a protein obtained from barley. It is insoluble in water and in absolute alcohol but dissolves in 70-80 per cent alcohol.

**HOREHOUND**, a perennial plant growing on wastelands throughout the United States, belonging to the Mint family, *Labiatae*. Horehounds are woolly, aromatic herbs with white flowers crowded in dense axillary whorls. One species, the white horehound, *Marrubium vulgare*, has circles of dull flowers about its stem, and round or ovate cut leaves. Another species, black horehound, *Ballota nigra*, also has downy wrinkled leaves but the flowers are purple and have a disagreeable odor. The leaves and flowering tops of white horehound are dried and used to flavor cough remedies, candies, and beer.

**HORIZON**. The true, or astronomical, horizon is the GREAT CIRCLE of the celestial sphere midway between the ZENITH and NADIR; it is the circle in which a plane perpendicular to the plumb line intersects the celestial sphere. A surface of mercury in a pan is part of this plane and provides a good artificial horizon. The sensible or visible horizon, however, is the apparent boundary between earth and sky which on land is irregular, but at sea is a circle that dips somewhat below the true horizon because of the curvature of the earth. If  $h$  is the elevation in feet of the observer above the earth's surface, then approximations to the distance of the apparent sea horizon and to its dip



The Horizon of a person at O (on the left) is the great circle of the celestial sphere midway between his zenith Z and nadir R. N, W, S, and E are the north, west, south, and east points of his horizon

The Dip of the Horizon for an observer at E (on the right) is the angle CED between the true horizon BC and the visible horizon ED. The observer's altitude  $h (=AE)$  is much exaggerated

below the true horizon are given by the formulas:

Distance (in statute miles) =  $1.22 \sqrt{h} = \sqrt{1.49h}$

Dip of horizon (in minutes of arc) =  $\sqrt{h}$ .

**HORIZON, ARTIFICIAL**. See ARTIFICIAL HORIZON.

**HORMISDAS, SAINT**. See POPE.

**HORMONES IN MAN AND OTHER ANIMALS**.

See ENDOCRINE GLANDS; INSECT.

**HORMONES IN PLANTS**, are chemical agents which are manufactured by plants and which regulate the various growth processes. Three hormones have been isolated from plants and their chemical constitution determined: auxin A or auxenticolic acid ( $C_{18}H_{32}O_6$ ); auxin B or auxenolonic acid ( $C_{18}H_{32}O_5$ ); and heteroauxin or indole-3-acetic acid ( $C_{10}H_9O_2N$ ). These hormones are synthesized principally in young leaves, buds, and in certain embryonic tissues, and occur in highest concentrations in such parts. Light is essential for the synthesis of these substances. Hormones are universally present in plants and are apparently non-specific in action; that is, the same hormones seemingly are effective in regulating growth in all species of plants, and they are active in exceedingly minute concentrations. They can be translocated from one part of a plant to another, moving chiefly from one living cell to another.

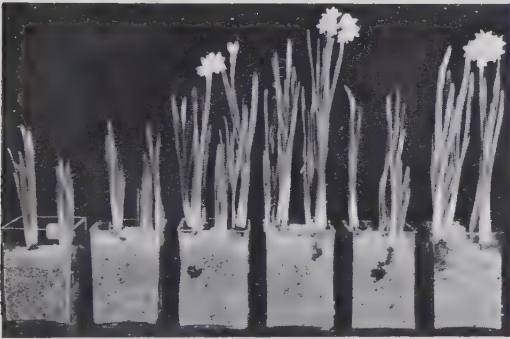
**Growth Hormones**, or auxins, are involved in the control of a number of growth phenomena, among which are: cell wall elongation, cambial growth, root formation, falling of leaves and fruits, and correlation between different parts of a plant. For example, in stems the terminal bud is often dominant and capable of active growth, while many lateral buds remain dormant. This inhibition of one bud by another is connected with complex hormone relationships between the terminal and lateral buds. The development of the ovaries of flowers into fruits is controlled in large degree by hormone activity. In the absence of normal pollination, seedless fruits can be made to develop by treating the ovaries with auxins. Reactions of plants to external stimuli also are related to auxin behavior. If a stem is illuminated more brightly on one side than on another, a migration of some auxins from the brightly lit side to the darker side occurs; as a result, more rapid growth occurs on the darker side, and the stem bends toward the light.

**Other Growth Substances**. Various organic compounds similar in chemical nature to the three known plant auxins have similar physiological effects when applied to plants. Such compounds are sometimes called hormones, but this use of the term is scarcely permissible. The designation hormone should be limited to substances normally produced by plants, while the term *growth regulating substances* should be used for these similar but not naturally occurring compounds. Growth regulating substances are used



commercially to retard fruit drop and to accelerate the formation of roots on cuttings, and they may achieve practical value in the near future in the development of seedless fruit.

There is experimental evidence that other hormones besides the known auxins are present in plants, although their chemical isolation has not yet been possible. The process of flowering is apparently con-



GENERAL BIOLOGICAL SUPPLY HOUSE

#### Effect of Hormones on Plant Growth

Same narcissuses appear in two stages of growth in, left to right, distilled water; distilled water plus vitamin B; plant nutrient solution; plant nutrient solution plus vitamin B; distilled water plus hormone powder dusted on bulbs when planted; plant nutrient solution plus hormone powder dusted on bulbs

trolled by a hormone, which has been tentatively named *florigen*. There are also apparently *wound hormones*, which are formed or activated when plant tissues are wounded and which may be involved in healing processes. See GROWTH IN PLANTS.

H. J. FULLER

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**HORN, STANLEY FITZGERALD**, 1889–, American author and editor, was born near Nashville, Tenn. In 1908 he joined the staff of the *Southern Lumberman*, becoming editor and half owner in 1917. His books include *Boy's Life of Robert E. Lee* (1935), *The Invisible Empire* (1939), *This Fascinating Lumber Business* (1943), *Gallant Rebel* (1947).

**HORN, TOM**, 1860–1903, American gunman, was born in Scotland County, Mo. At 14 he began an itinerant career as a scout, Pinkerton detective, and gunman for the cattle barons of the West. He was arrested (1901) and convicted of the murder of Willie Nickell, a boy of 13. He escaped jail in Cheyenne, but was recaptured and hanged. While in jail he wrote an autobiography, *Life of Tom Horn: Government Scout and Interpreter* (1904), generally conceded a greatly exaggerated account.

BIBLIOG.—J. Monaghan, *Last of the Bad Men: The Legend of Tom Horn* (1946).

**HORN**, in music. See FRENCH HORN; ENGLISH HORN.

**HORN**, as typically represented in the hollow-horned ruminants, an unbranched sheath placed upon the top of cores of bone developed from the frontal bones of the skull, and exemplified in oxen, sheep, and antelopes. Horns differ from antlers, not only in the horny sheath, but in the fact that neither core nor sheath is shed throughout life. In some cases, as in the majority of antelopes, horns are confined to the male sex; in others they occur in both sexes. Functionally they are weapons, and can often be used with the most deadly effect. Certain other simpler types exist among ungulates, some of which seem to show transitional conditions between horns and antlers. In the prongbuck (*Antilocapra*) the remarkable horns are branched, and the horny sheath is periodically cast and renewed. In the giraffe the "horns" are bony prominences, at first entirely separate from the bones of the skull, but later uniting with these, and covered by hair. Other remarkable hornlike structures occur among some of the extinct allies of the giraffe. The horn of the rhinoceros has no connection with the bones of the skull, and consists of a mass of horny fibers. Horns are utilized in many ways, such as for handles and ornaments.

**HORN, CAPE**, Spanish *Cabo de Hornos*, Chile, the southernmost point of South America, a desolate rock about 600 feet high, on Horn Island, S of Tierra del Fuego. In 1616, the Dutch navigators Schouten and Lemaire discovered the headland and named it after Hoorn, the birthplace of Schouten in the Netherlands. The surrounding region is stormy, and during the days of sailing ships the trip around the Horn was always a great hazard.

**HORN FLY**, *Haematobia irritans*, a biting FLY that pesters horned cattle. It resembles the housefly but is only about half as large. These flies settle in clusters about the base of the horns of cattle and suck blood. They breed in fresh cow dung. They may be controlled by spraying the cattle with methoxychlor or pyrethrum.

**HORNADAY, WILLIAM TEMPLE**, 1854–1937, American zoologist, was born in Plainfield, Ind., and attended Iowa State College. After visiting various parts of Asia and Latin America as a collecting zoologist, he became chief taxidermist with the U.S. National Museum (1882–90). In 1896 he went to New York City, where during the next 30 years he directed the park of the New York Zoological Society. He promoted the establishment of the Montana National Bison Range, the Wichita National Bison Range, and the Elk River Game Reserve. During the Taft and Wilson administrations he was instrumental in securing the passage of legislation for the protection of wild life and fought especially against the importation of wild bird plumage for millinery. Among his books is *American Natural History* (1904), long regarded as a classic by zoologists.

**HORNBEAM**, also called *Ironwood*, a tall tree native to Asia, Europe, and North America, belong-



U.S. FOREST SERVICE

The leaves and bark of the hornbeam tree

ing to the Birch family, *Betulaceae*. European hornbeams, *Carpinus betulus*, grow to a height of 70 feet and are characterized by rounded ovate leaves. Another hornbeam, *C. caroliniana*, the blue beech, is found chiefly along streams. Blue beeches have sharply cut leaves and catkins of fertile flowers. A smooth gray bark covers a brown wood, noted for its hardness, strength, and durability. The wood is used for fence posts, levers, and handles.

**HORNBILL**, an interesting bird, widely distributed in the warmer parts of the Old World, constituting the family *Bucerotidae*, and characterized by the greatly developed bill, which is surmounted by a bony excrescence, the "helmet." These birds dwell in forests, and are slow and unwieldy in flight. Their food consists usually of fruit and insects, but the larger forms are very indiscriminate as regards diet. The rough nest is placed in a hole in a tree, and the entrance is then closed up with plastered mud and excrement, probably by the hen, until only a small opening is left. Through this the male feeds his mate, and she remains within until the young are hatched. This and other remarkable habits have given rise to many myths in the countries in which hornbills occur.

**HORNBLLENDE** is an aluminous variety of amphibole quite common in crystalline rocks, generally black in color, but sometimes green or dark brown; sp gr=3.0, h.=5.5. The term hornblende is commonly used in petrography as a generic name for the whole series of monoclinic amphiboles. As a rock constituent it is found in many lavas, in plutonic rocks, specially in granite, syenite, and diorite of which it may be an essential constituent. It is also common in metamorphic schists. Hornblende is easily recognized by its dichroism and well-developed cleavages, which intersect at an angle of 124° in sections transverse to the prism axis. In metamorphic rocks this mineral usually forms irregular masses without definite crystalline form. Augite, which is almost equally common in rocks, is so like hornblende in color, hardness, and specific gravity, that it can hardly be distinguished, except by its cleavage angle and by its optical properties when examined under the microscope. Hornblende decomposes with formation principally of chlorite, but also of epidote, calcite, and limonite. See AMPHIBOLE.

**HORNE, FREDERICK JOSEPH**, 1880—, American naval officer, was born in New York City. He participated in the Battle of Santiago (1898) of the Spanish-American War before his graduation from the U.S. Naval Academy, later served in the Philippine Insurrection, and was naval attaché at the American embassy in Tokyo (1915-19). He became president of the Naval Examining and Retiring Board (1934-35), commander of aircraft, Base Force (1935) and Battle Force (1936). A member of the General Board (1938-41), during World War II he was vice chief of Naval Operations, with responsibility for preparation, readiness, and logistic support of forces afloat (1942-45). He was promoted to admiral in 1945, and retired in 1946.

**HORNE, RICHARD HENRY**, or **HENGIST**, 1803-84, English author, born in London, served as a midshipman in the Mexican navy in the war with Spain. He wrote tragedies and satires; investigated the employment of children in mines; carried on a correspondence with Elizabeth Barrett; and in 1843 published *Orion*, an epic poem.

**HORNED SCREAMER**, a South American forest bird of a glossy black color, with white on the head, wings, and abdomen. The head bears a long, slender horn. This bird, *Anhimus cornutus*, belongs to the family *Anhimidae* and is allied to the goose, though its habits are more like those of the turkey.

**HORNED TOAD**, any of many species of small, squat, short-tailed, earth-colored LIZARDS, mostly of the genus *Phrynosoma*, and allied to iguanas, which inhabit the arid southwest of the United States, and

the plains of Mexico. They bristle with knobs and spikes, and make a great show of anger when threatened, but are entirely harmless. They feed upon insects, are reproduced by eggs laid only a few hours before hatching, and make amusing pets.

**HORNED VIPER**. See ASP.

**HORNELL**, city, New York, Steuben County, on the Canisteo River and the Erie and the Pittsburgh, Shawmut, and Northern railroads; 70 miles SE of Buffalo. The site was cleared by Benjamin Crosby in 1790, and the settlement was named Hornellsville for George Hornell, an Indian trader who bought the land in 1793. The city developed industrially after the arrival of the Erie Railroad in 1850. Hornell is the railroad division headquarters and has manufactures of electrical machinery, farm tools, brick, wire, hosiery, gloves, shoes, and printed and dyed cloth. Pop. (1950) 15,049.

**HORNET**, one of the most common European species of social wasp, distinguished by its large size and bright red-brown markings. This wasp, *Vespa crabro*, has been introduced into the United States near New



LYNWOOD M. CHACE

Side view of young yellow jacket in cell

York; and there is a native American species, *V. maculata*, of similar habits, which builds a very large pear-shaped paper nest in trees. All the colony dies off at the approach of winter save a female, who in spring begins to build the nest in hollow trees or in outhouses. Later, as in other social wasps and bees, she is assisted



HUGH SPENCER/ACME

Paper Hornet Nest hangs on tree, left. View of nest built against window, right, shows structure

in her labors by workers. Hornets feed on other insects, and display great dexterity in catching their prey. The sting of the females is severe, but hornets do not usually attack man unless molested. See WASP.

**HORNSBY, ROGERS**, known as *Rajah*, 1896—, American baseball player and manager, member of Baseball Hall of Fame, was born in Winters, Tex. A second baseman, he played with the St. Louis Cardinals (1915-26, 1933), New York Giants (1927), Boston Braves (1928), Chicago Cubs (1929-32). He was manager of St. Louis (1925-26), Boston (1928), Chicago (1930-32), and the St. Louis Browns (1933-37). Hornsby, one of the greatest right-handed bats-



## Hornstone

men of all time, had a lifetime major league batting average of .358. He was National League batting champion three times (1912-23, 1925, and in 1924 he set the 424 hit modern National League record. He was named the league's most valuable player in 1925 and 1928.

**HORNSTONE**, a compact, flinty variety of chalcedony, rather more brittle than flint but tough enough to drill in color and texture. See **QUARTZ**.

**HORNTAIL**, any of various insects related to the weevils which injure trees by boring holes into the new wood beneath the bark. Here the eggs are laid and the young larvae eat out large galleries. One species greatly damages the new shoots in oyster plantations.

## HOROLOGY

### The Science of Time-Keeping

*From the sundial to the electric clock*

**HOROLOGY** is the science of time measurement and the design, construction and upkeep of timepieces. The sundial is believed to have been the earliest form of timekeeper and was in use in China and India as early as 2500 B.C., later being introduced into Babylon and Egypt. The Chinese use Water Clock is also of very ancient origin and may be as old as the sundial. The dates of the origin of both are unknown. Other forms of early timekeepers are graduated candles, such as are said to have been used by King Arthur in the sixth century, lamps with graduated oil containers, and candlesticks, forms of which are used for some purposes today. See **HOROSCOPES**.

**Clocks**. The art of clock and watch making is a thought first took practical shape in Germany, and there is positive proof that, about 1304, Charles V of France summoned one Henry de Vicks from that country, commanding him to make and fit up a large



Time Candle indicated passing of time by position on the dial of a shadow cast by the burning candle



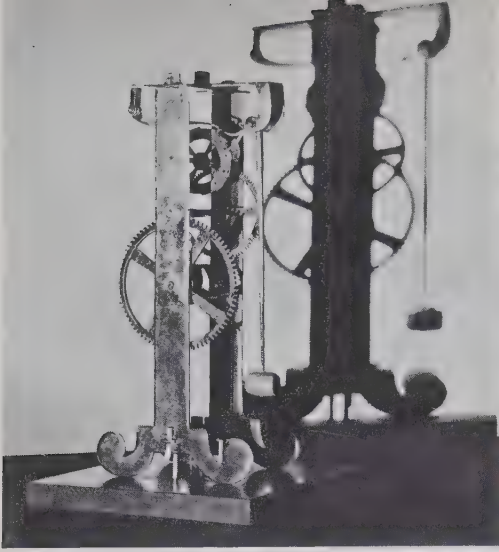
EARLIEST NATIONAL WATCH CO.

### The earliest type of spring-driven clock

water clock at his palace in Paris. De Vicks's clock was regulated by a balance, the pendulum not having been yet invented. The escapement is that part in a clock or watch which prevents its running down too quickly. It consists of the last and quickest moving wheel in the train, along with the pallets which communicate the energy to the pendulum or balance. A train consists of a number of wheels which gear together. In a timepiece, the force, generated either by weight or spring, is transmitted by the train to the escapement, and in a clock there is also an additional train, for the purpose of making it strike the hours.

A pendulum is to be considered as a falling body; and if it moved in a cycloidal path, the time of its vibrations, although of different amplitudes, would remain the same. But, in actual practice, the path of the pendulum is circular, and any increase in the extent of vibration will take longer time. This variation is known as the circular error; and in order to keep it as low as possible, the swing of the pendulum is kept within reasonable limits, so that the arc described by the pendulum varies very little from a cycloid. There are other errors which affect the pendulum, such as the barometric error, due to any change in the density of the air through which it swings; the temperature error, caused by the expansion and contraction of metals; and, lastly, the escapement error, being the extent to which the escapement may interfere with the regular movement of the pendulum. During an impulse given by the escapement to the pendulum, the first half helps it down, and the second half assists it to ascend on the other side. Gravity helped and hindered, the one action compensating for the other. The temperature error is the one which most affects the time of a pendulum, and, to counteract this, the compensation pendulum was devised. The length of a pendulum is calculated from the point of suspension to an imaginary point in the pendulum bar, called the center of oscillation, this point being slightly below the center of gravity of the pendulum. As every change of temperature alters the length of the pendulum rod, this point will be either raised or lowered, causing in the former case quicker and in the latter slower vibrations. The object of compensation is to keep the center of oscillation always at the same distance from the point of suspension. John Harrison, who began life as a carpenter, invented the first compensation pendulum, known as the gridiron. It has long been superseded by others, and among the best of these may be considered George Graham's mercurial pendulum.

About 1656, Dr. Robert Hooke, professor of geometry in Gresham College, London, invented the anchor escapement. The verge escapement, while requiring considerable motive force, was extremely sensitive to any variation in the power. The pendulum was short and light, and took a large arc of vibration, giving prominence to the circular error. With the new escapement longer and heavier pendulums were used,



ELGIN NATIONAL WATCH CO.

### Galileo's clock incorporated first pendulum

and the arc of vibration was lessened to such an extent that the circular error became insignificant. The heavier pendulum was also less influenced by any irregularity in the clock itself, or in the force which kept it in motion. This escapement is still the one most commonly used, being easy to make, and giving very good results.

Toward the end of the 17th century, George Graham, doubtless on the initiative of Hooke, produced his dead-beat escapement, which is the one now used in the better timekeepers. In the verge and anchor escapements, when a tooth of the escape wheel has given its impulse, and escaped from the one pallet, the other pallet receives a tooth on its face, which not only checks the forward motion of the wheel, but drives it back a certain distance; from this action the anchor is also known as the recoil escapement. Again, any increase of power in a recoil escapement causes the timepiece to gain, the opposite being the effect in the dead-beat. In the latter, when a tooth in the escape wheel has given its impulse to the one pallet, the other pallet receives a tooth and stops the wheel; but, owing to the face of the pallet being concentric with the arbor, to which it is fixed, the wheel is not driven back, but locked, and it remains stationary until the next forward movement: this gives the name of dead-beat. In this escapement the vibrations of the pendulum are not allowed to go beyond certain limits, and the impulses being equal, it is much superior to the anchor.

Large clocks, such as those required for church steeples and the towers of public buildings, are subject to irregularities which do not interfere with the ordinary house clock. They have from one to four dials, and the hands are of considerable size and weight. The hands are poised by short levers with weights attached; otherwise, when descending from 12 to 6 they would unduly press the clock forward, and in ascending from 6 to 12 they would greatly retard it. In stormy weather they are forced backward and forward by the wind, and in winter they have sometimes to contend with snow. In order to overcome these difficulties, a greater weight than would otherwise be necessary is used; and as this force is sometimes assisted and sometimes held back, it depends on the escapement whether the variations will show in the timekeeping. To avoid the consequences of these irregularities, the gravity escapement was introduced.

**Electric Clocks.** About 1840, Alexander Bain was the first in Great Britain to use electricity in connection with clockwork. Electricity is used in three ways—(1) to control clocks at a distance from a standard clock; (2) to bring the different clocks in a circuit to the same time, usually at the end of each hour; and (3) as

the motive power. In the first method, the pendulum of the controlled clock is of the same theoretical length as the standard one. The pendulum ball is a hollow cylinder coiled with insulated wire; it passes over two permanent magnets, and reversed currents, sent by the oscillations of the standard pendulum, repel or attract the controlled one, bringing their oscillations into unison. Another and more popular method is to have a simple dial of one ratchet wheel having 120 teeth. This wheel carries the minute hand, and receives an impulse forward every half minute. This forward movement is caused by a rocking armature pivoted at one end, and provided with a clutch, which is made to slide over the teeth by the current being sent along the wire and exciting an electromagnet which pulls the armature toward itself. Immediately on the circuit being broken, a spring which is fixed to the armature pulls it back into its normal position; the clutch at the same time catches on the face of a tooth in the wheel and pulls it over. The wheel has also another clutch, to prevent it from taking more than one tooth at a time. The second method is worked by having two clips at the top of the dial, which, by means of an electric current, are made to close down over the minute hand exactly at 12 o'clock, thus bringing the clock to time, whether it has gained or lost.

The third method, in which electricity is the motive power, is widely used. Individual clocks, driven by small synchronous motors connected into the electric light circuit, are maintained at a constant rate by controlling the frequency of the output at the central power station. Telegraphy is used in synchronizing clocks by transmitting to them time signals from a master clock. This method is employed to keep the clocks of the telegraph companies in step with the master clock at the U.S. Naval Observatory. Compressed air has been used to move dials, which are simply time indicators, the air being forced through small tubes at intervals, controlled by a standard clock.

**Bells and Chimes.** It is believed that early horological machines had no striking part. The first step in this direction was an alarm-striking apparatus, and afterward a hammer was made to strike a bell a certain number of times, according to the hour. This required a train of wheels to itself; and a contrivance called a "count wheel" had its circumference so divided, in proportion to the hour, that, at the finish of striking, a lever fell into a notch on the edge of the wheel, and locked the train until the next hour. This arrangement has the serious drawback that, if the hands are turned back, the clock will strike in advance of the hour indicated. A more modern and improved device is the hour rack. This is the segment of a circle with 12 teeth cut in the edge. From the center of motion of this piece a small lever projects, which falls into steps of a relative depth on the edge of a snail which is fixed to the hour wheel. The clock in

### Nuremberg Egg was first watch with main spring

ELGIN NATIONAL WATCH CO.





## Horoscope

striking gathers up the rack by a pallet, which is fixed to a wheel, which makes one revolution for every blow struck. Bells are most commonly used to make the hours audible, but there are other means, such as gongs, which are simply coiled wires, and give out a softer and more mellow tone. Another contrivance is a steel tube of such diameter and length as will give the desired pitch. The hammer face is covered with chamois leather, and is made to strike the tube, which is suspended by a cord at the upper end. A trichord similar to those of a piano is also sometimes used. The striking may be either simple or complicated, as when a chime is given on bells or gongs, or both together. In a chiming clock an extra train of wheels is necessary for that purpose. The chimes are generally struck on eight or ten bells; and in clocks with the tubes there is always the full octave, with an extra long and large tube for the hours. Where gongs only are used, there are usually four for chiming and one for the hour, though some very fine clocks have been made having the full octave and an additional gong for the hours.

**Raised Weights** were at first used as the motive power for driving clocks; and where there is sufficient room, and no necessity for moving the timepiece, this is the best method, as, the force of gravity being constant, the weight always falls with an equal force. But a weight-driven machine cannot be portable; and on the invention of the mainspring by Peter Hele of Nuremberg, about 1500, smaller clocks were made, which could be more easily moved. The mainspring of a clock or watch is a band or ribbon of steel, which, on being wound tightly round an arbor, endeavors to unwind itself, and in so doing gives out the power in the work of making the timepiece go. The force of a spring varies considerably, being weaker when nearly run down, and much stronger when wound up to the top. In 1525 Jacob Zech of Prague invented the "fusee," which is a hollow-sided cone for the purpose of equalizing the pull of the mainspring, the large diameter at the one end giving out the weaker force of the spring, and the smaller diameter at the other being for the greater force when the spring is fully wound. See **TIME**; **UNITED STATES NAVAL OBSERVATORY**; **WATCH**.

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**HOROSCOPE.** See **ASTROLOGY**.

**HOROWITZ, VLADIMIR**, 1904—, Russian pianist, was born in Kiev, of well-to-do parents. His pianistic talent, manifested early, was furthered by study at the Kiev Conservatory under Felix Blumenfeld. In 1922 he made his debut, which was enthusiastically acclaimed. He followed this in 1923 with 70 concert appearances in Russia and, in 1924, with the first of several tours of Europe. His American debut was made at Carnegie Hall in 1928, where his command of technique brought forth the praise of audience and critics. After that, except for a self-imposed absence from the piano (1936–38) he continued to enhance his reputation by recordings and by concert tours in America and Europe.

**HORROCKS, or HORROX, JEREMIAH**, 1617–41, English clergyman and astronomer, was born in Toxteth, near Liverpool, studied at Cambridge University, and following his ordination in the Church of England became curate of Hoole, Lancashire. He was the first to predict and observe a transit of Venus (1639), described in *Venus in Sole Visa* and published in Germany in 1662. He also advanced the theory that the moon's orbit is an ellipse with the earth at one of the foci, made a series of observations on the tides, and detected an irregularity in the mean motion of Saturn and Jupiter.

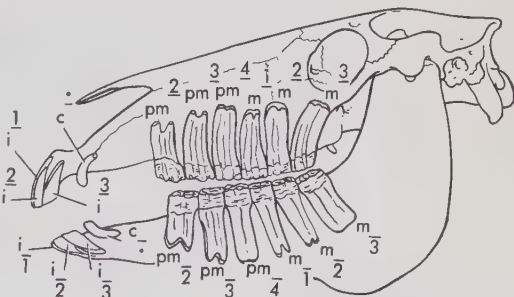
**BIBLIOG.**—H. S. Williams, *The Great Astronomers* (1930).



CONSULATE GENERAL OF DENMARK

**HORSE**, an even-toed ungulate belonging to the family *Equidae* of the order *Perissodactyla*. Although the term horse in the widest sense applies to any member of the family, i.e., horses, asses, or zebras, it usually denotes the domestic horse, *Equus caballus*. This horse differs from its close relatives in having a flowing mane, a tail completely covered by long hairs, a bare callosity, known as the "chestnut," on the inner side of the hind limb, comparatively short ears, slender head, long legs, and broad hoofs. Of the many wild species of horses that once existed there remains only one true wild horse, *E. przewalskii*. This sturdy animal, which is found in Mongolia, measures about 12 hands (a hand is equal to four inches) in height and is dun-colored, with the lower part of the legs black and a black stripe down the back. Other so-called wild horses are *feral*, i.e., descendants of domesticated animals that have escaped.

**Structure.** The distinguishing characteristics of the horse are found in the teeth and skeleton. During its lifetime the horse has two sets of teeth, a deciduous or milk set, which is gradually shed in the third and



AMERICAN MUSEUM OF NATURAL HISTORY

**Dental Battery of an Adult Horse**  
Skull and permanent teeth of a five-year-old horse:  
i, incisor; c, canine; pm, premolar; m, molar

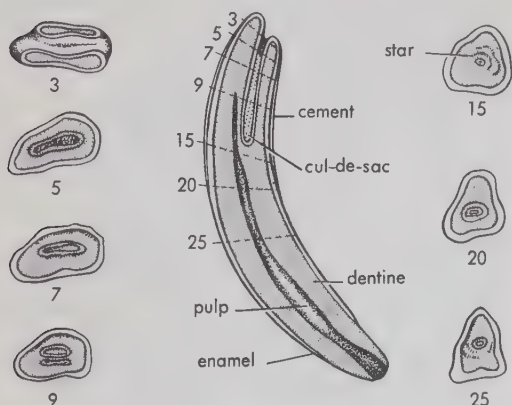
fourth years, and a permanent set. In the adult horse each half of the upper and lower jaws is fitted with three incisors, one canine, four premolars, and three molars. However, since the first premolars are reduced or even entirely absent, and the canine teeth are nonfunctional, the number of functional teeth in the horse is only 36. All of the teeth have extremely long, enamel-covered crowns that extend far below the gum line. As the surface of each tooth is worn away by use, the tooth moves up from the gum. Consequently it gradually changes in shape as the

horse grows older, becoming triangular and slanting outward. This provides a fairly accurate means of determining the horse's age. The incisors are especially useful age indicators because the masticating surface of each of these teeth bears an enamel-lined

with sharp enamel edges that have dentine on one side and cement on the other. Since these substances are softer than the enamel, they wear away faster and in this manner the tooth is kept sharp. Between the incisors and premolars is a space or *diastema*; it is in this space that the bit is placed.

The skull of the horse appears long, due to the extension of the facial region, and contains on each side an orbit (a depression which holds the eye) completely encircled by bone and placed well behind the last molar to allow for the development of the high-crowned teeth. For a similar reason the condyles of the lower jaw (the surfaces that articulate with the upper jaw) are raised above the masticating surface. The backbone of the animal is composed of 7 cervical, 18 thoracic, 6 lumbar, 5 sacral, and from 15 to 18 caudal vertebrae. Those of the neck, i.e., the cervical vertebrae, are elongate, and all joints, except those between the first and second neck vertebrae, are of the ball and socket type, providing strength and mobility. The vertebral column of the trunk is characteristically straight but the vertebrae have spinous processes of different lengths, thereby producing the curvature of the horse's back. Eighteen ribs spring from the thoracic vertebrae. The clavicle or collarbone is absent in the horse and the scapula or shoulder blade bears a weakly developed spine.

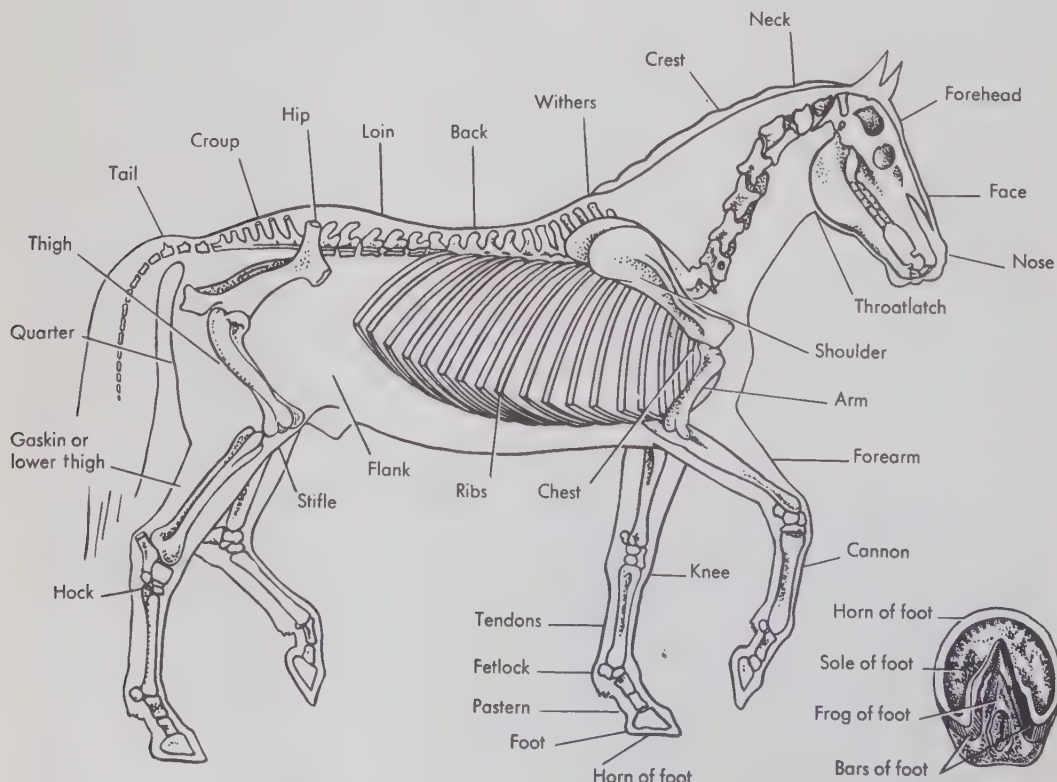
Horses differ from all other living animals in having only one toe, the third or middle toe. This bears the broad hoof, which is similar to a claw or nail in other mammals, and supports the entire weight of the body. The foot is greatly elongated, the so-called "knee" of the forelimb actually being the wrist and the "hock" of the hindlimb being the ankle. Extending from the knee to the fetlock joint is the longest bone of the foot, the cannon bone. On its back surface are two small splint bones, representing the second and fourth digits. That portion of the foot



### Age of Horses as Indicated by Teeth

Longitudinal section of left central lower incisor and cross sections of the same tooth showing table surfaces as they appear at the ages of 3, 5, 7, 9, 15, 20, and 25 years

depression, known as the *mark* or *cul-de-sac*. This unique structure is gradually worn away by abrasion and consequently becomes shallower with age. Premolars and molars are alike in structure but the premolars are heavier and more highly developed. In both types of teeth the grinding surface is equipped



HORSE AND MULE ASSN. OF AMERICA, INC., CHICAGO, ILL.

## SKELETON OF THE HORSE



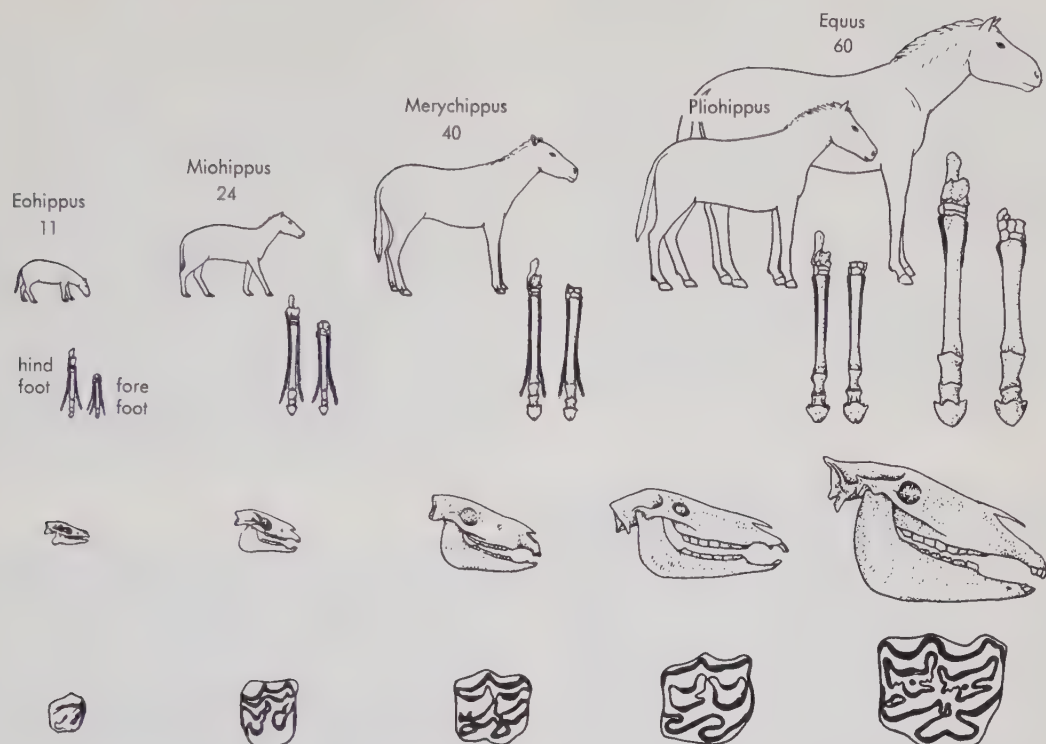
EOCENE

OLIGOCENE

MIOCENE

PLIOCENE

PLEISTOCENE-RECENT



R. S. LULL, "FOSSILS," UNIVERSITY SOCIETY, N.Y.;  
W. D. MATTHEW, 1913; AND R. P. STIRTON, 1940

### Evolution of the Horse

Outstanding features in the evolution of the horse are the increase in size, change in body conformation, reduction of the lateral toes, closing of the postorbital process in the skull, and increased complexity of the molar teeth. Numbers indicate height at the shoulder in inches

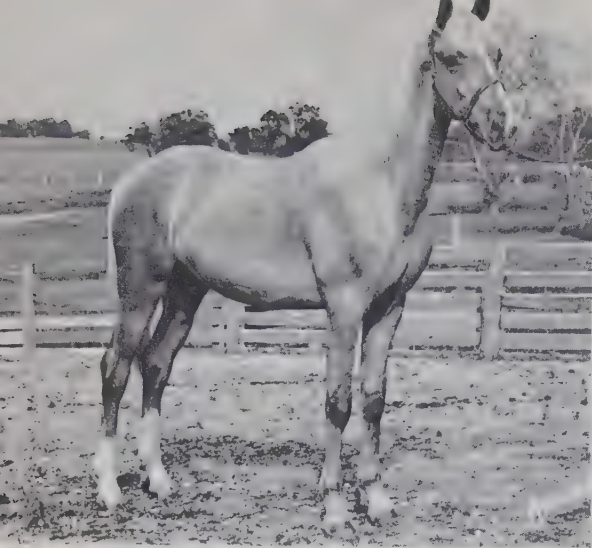
between the fetlock and the top of the hoof is known as the pastern. The two long bones of the forearm, radius and ulna, as well as those of the foreleg, tibia and fibula, are fused to form a single bone. Such adaptations, particularly the lengthening of the foot and the shifting of weight to the hoof, enable the horse to run swiftly over hard, flat ground.

**Domestication and Evolution.** The horse is essentially a plains animal and when living in a semi-wild state occurs in herds headed by a stallion. As a servant of man, it has found its way into nearly every part of the globe where habitation is possible. Just when the horse was domesticated is not certain but there is evidence that it was utilized by prehistoric man for food at least. The earliest indications of domestication in historical times were found in Russian Turkestan, and the remains of a horse similar to *E. przewalskii* are said to have been excavated from a stratum dated about 4500 B.C. Monuments and ancient inscriptions in Egypt indicate the use of the horse in that country some 3,500 years ago, undoubtedly for chariots of war. The animal of this period bore a striking resemblance to the existing wild horse of central Asia. It is also evident that from very early times definite efforts were made to improve the breed, and the writings of Xenophon in the fourth century B.C. discuss horsemanship and the development of horses for cavalry service. The domestic horse as it is known today is thought to have originated from at least two wild species which are now extinct—the Norseman's horse of Europe or northwestern Asia and *E. libycus*, formerly found in northern Africa.

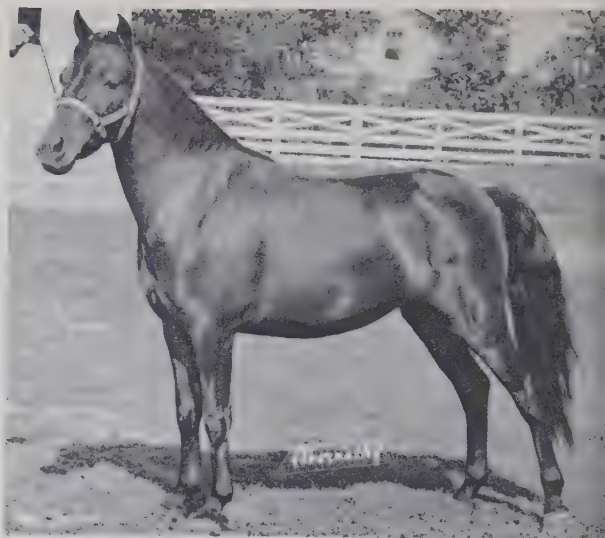
The numerous fossil horses found throughout the

Tertiary period (the Age of Mammals) and the Pleistocene afford an almost complete history of the evolution of the horse. The earliest known forms are *Hyracotherium* of the Lower Eocene of England and *Eohippus*, found in the Lower Eocene of America. They are almost identical, the chief difference lying in the greater complexity of the teeth of *Eohippus*. This animal stood three hands high and had a slender face in which the orbits were incompletely closed posteriorly by bone. The neck was short; the forearms and forelegs each had two separate bones. Long hind legs produced an arched back. The feet were short and those of the forelimbs had four complete toes, while those of the hindlimbs had only three toes, with vestiges of two more. The comparatively simple teeth lacked cement and were short crowned with low, rounded knobs on the molars.

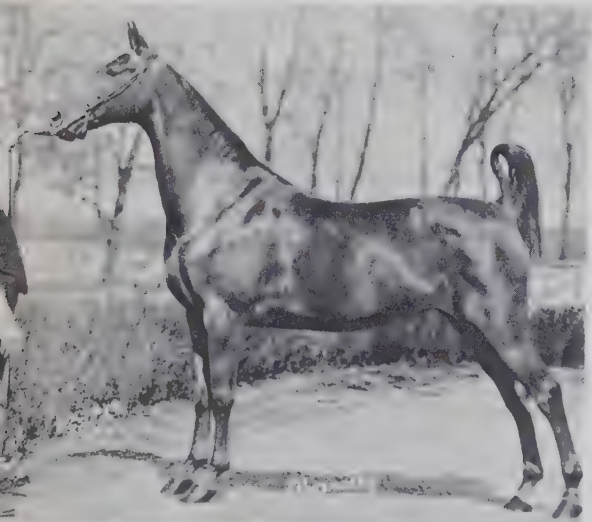
Some millions of years later, in the middle Eocene, lived *Orohippus*, similar in most respects to *Eohippus* but standing about four hands high. The middle toe of this animal was somewhat larger and the two toe vestiges on the hind feet had disappeared. The teeth were still short-crowned and lacked cement but the fourth premolars resembled true molar teeth. *Mesohippus* of the late Oligocene comprised several species. It was about the size of a coyote, and though still unspecialized, showed a longer neck with the beginning of ball and socket joints and a partial fusion of the bones of the forearm. Only three toes were present on each foot, the middle toe being greatly enlarged. The short-crowned teeth lacked cement and had completely formed crests on the crowns. The second, third, and fourth premolars were entirely molar-like. *Merychippus* of the middle Miocene is interesting be-



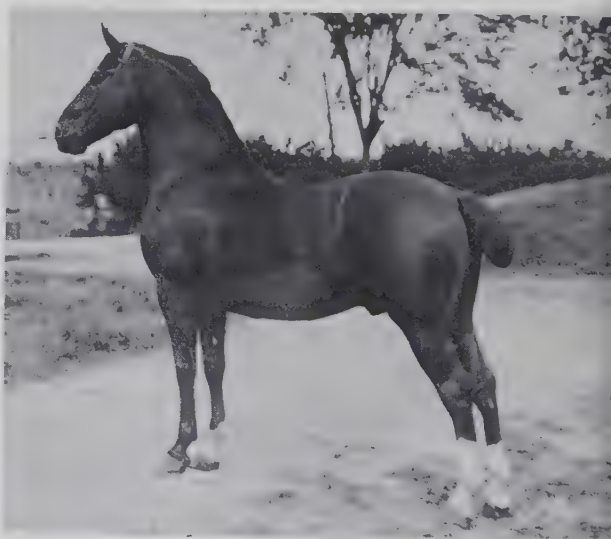
Palomino colt



Shetland pony

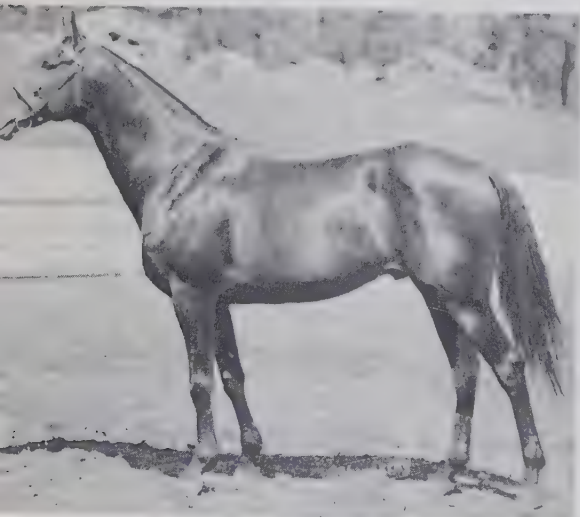


Saddle horse



French coach horse

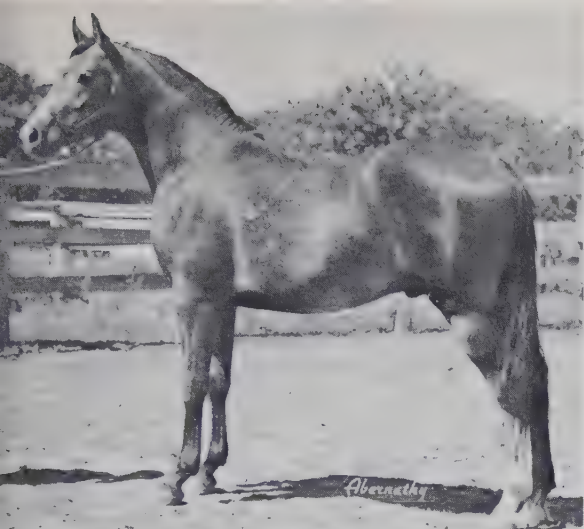
Morgan horse



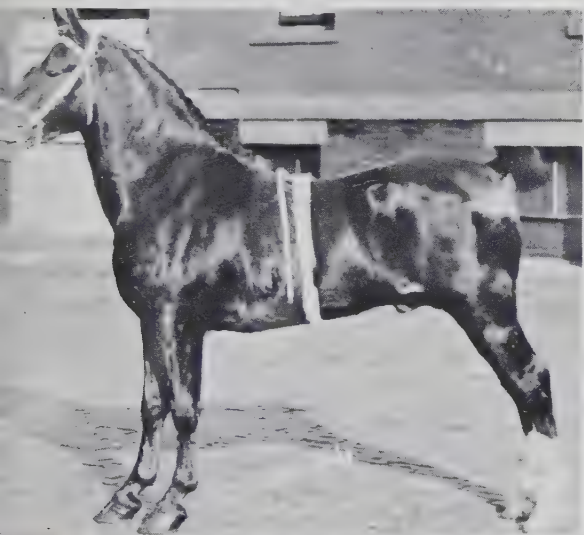
Thoroughbred







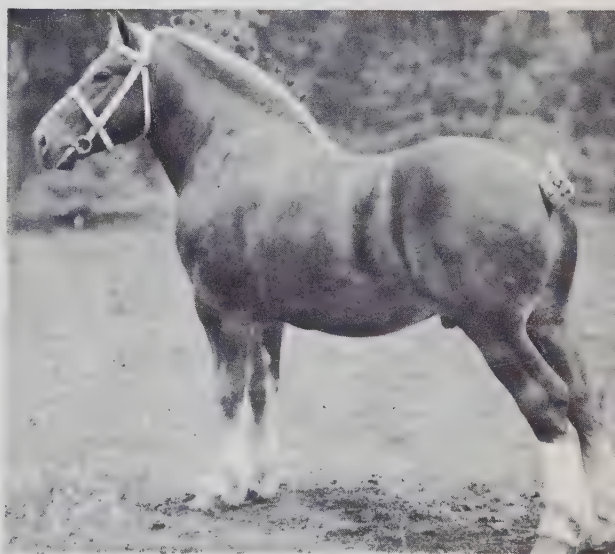
Arabian horse



Hackney (above)



PERCHERON HORSE ASSN. OF AMERICA  
Percheron stallion



Belgian stallion

Trotting horse (below)

J. F. ABERNATHY

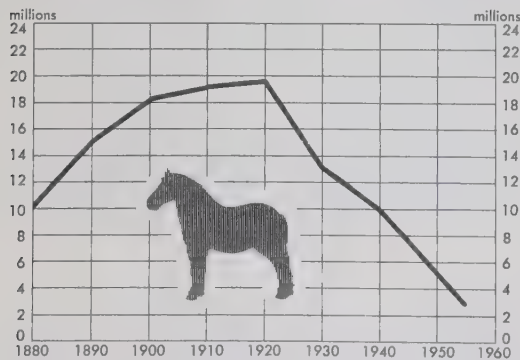


cause of its strikingly transitional teeth. The permanent molars had moderately long crowns and were heavily cemented but the milk teeth were short-crowned and had little or no cement. The first one-toed form to appear was *Pliohippus* of the Pliocene. In this form the side toes were reduced to mere splint bones that were almost as long as the cannon bone. *Plesippus*, appearing later in this period, exhibited a very modern skeleton almost comparable in size and proportions to the present-day Arabian horse. The teeth of both forms had longer crowns and enamel biting ridges on the surface but still differed considerably from the teeth of the modern horse. An important advance was the reduction of the fibula of the hindlimb so that the entire weight fell on the tibia. *Equus*, the genus of modern horses, appeared during the Pleistocene.

The significant changes concerned in the evolution of the horse may be summarized as follows: a continuous increase in size; an increase in the complexity of the teeth; a lengthening of the feet with a reduction of the lateral digits and an increase in the length of the third digit; an elongation of the face and the complete enclosure of the orbits by bone; a lengthening of the neck and the development of ball and socket joints in the neck vertebrae; a lengthening of the limbs together with a fusion of tibia and fibula as well as of radius and ulna; and a straightening of the vertebral column.

#### BREEDS OF HORSES

Many breeds and types of modern horses have been developed from the prehistoric horse and serve a variety of uses. With regard to use they may be classified as saddle, harness, or heavy draft horses. The selection of a horse is based upon personal preference, the use to which the horse will be put, the supply from which the selection may be made, and the market available for animals to be sold. In the United States farmers have mares mated to stallions which



Number of Horses on Farms in the United States

stand-at public service for a stated fee. Breeders of purebred horses, however, are more careful of the matings and study the bloodlines of the ancestors. Such studies permit these persons to predict with reasonable accuracy the results of particular matings. It is not an exact science but an art at which certain breeders have become highly proficient.

**Saddle Horses.** Light horses are developed for speed, style, endurance, and comfort of riding. To this end the shoulders and pasterns of the light horse are long and sloping, in order to give the legs a springy action and so ease the ride; the back is strong enough to carry a rider; and the muscles are long and lithe for rapid contraction and snappy action of the limbs. Among the best known breeds of light horses is the *Thoroughbred*, a name that is often incorrectly applied to purebred horses, i.e., horses that are eligible to registry in the herd books of a definite breed. The foundation of the Thoroughbred breed was formed by three oriental stallions, the

Byerly Turk, the Darley Arabian, and the Godolphin Barb, which were imported by Charles II of England and mated with native mares and two mares from Barbary, known as the "royal mares." The Thoroughbred registry is based directly on three sires bred in England about 1750: Herod, a direct descendant of the Byerly Turk; Matchem, a grandson of Godolphin Barb; and Eclipse, a descendant of the Darley Arabian. Thus the breed derives its origin from the union of Arabian, Barb, and Turkish blood with the native English, a combination that gives these horses symmetry, endurance, and speed. Thoroughbreds are saddle horses, developed solely for speed, and run at a gallop. They stand from 15 to 16 hands high, weigh from 900 to 1,050 pounds, and may be bay, brown, black, sorrel, gray, or roan in color. In America the best Thoroughbred record for the mile is 1 minute 33-3/5 seconds, set by Citation in 1950. See HORSE RACING.

The *Arabian* has deeply influenced all breeds of light horses. It is small, standing 14-14½ hands and weighing 800 to 900 pounds, and is exclusively a riding horse with great endurance but not exceptional speed. Bay, chestnut, and gray are the common colors, brown and black less common. The Arab has a broad forehead, prominent eyes and nostrils, clean limbs and feet, and carries itself with great style. Wherever bred is has transmitted constitution, intelligence, quality, and style.

The ancestry of the *American Gaited* saddle horse, which was developed in Kentucky, lies in the Thoroughbred. This pleasure and exhibition horse stands 15 hands or more, weighs just over 1,000 pounds, and is trained to walk, running walk or slow gait, trot, canter, gallop, and rack or single-foot. It is now bred practically for show purposes alone.

*English Hunters* are also a type of Thoroughbred, selected for large bone, short legs, and compact body formation. They stand about 15 or 16 hands and weigh from 1,000 to 1,250 pounds. Widely used as cavalry horses, hunters are usually trained to walk, trot, canter, and gallop, in addition to clearing obstacles, such as gates, fences, and ditches.

The *American Quarter* horse has been developed for handling cattle and for other kinds of ranch work. It was formerly used for quarter racing, i.e., quarter-mile races over rough paths, and is notable for its speed. Quarter horses are powerful, well-muscled animals, measuring 15 hands in height and weighing 1,200 pounds. They are descendants of the Thoroughbred and the native mare.

In recent years the *Tennessee* or *Plantation Walking Horse* has gained great popularity. This also is a type rather than a distinct breed, though some of its characteristics are well recognized. Walking horses are plain but good-looking and intelligent animals that stand 15 or 16 hands and usually weigh more than 1,000 pounds. Their gait is exceptionally smooth, with a long stride and little rise and fall to the saddle. The usual colors are bay, chestnut, roan, black, or gray; an outstanding characteristic of the breed is prominent white markings. These horses are all-purpose animals, being used principally for riding but also for driving and farm work.

*Palominos* were developed by Mexican ranchers and are descended from the Saracenic and other strains brought to Mexico by the Spanish conquerors. In Old California they were used as race horses but with the coming of the Thoroughbred and other breeds lost favor. Today the Palomino is again becoming popular and is bred for riding. It is a showy horse, golden in color with a light mane and tail. In height it averages from 15 to 16 hands and in weight from 1,000 to 1,200 pounds. Three types are recognized: the parade type, the bridle path type, and the stock horse.

**Harness Horses.** The most important breed of harness horse is the *American Standard Bred*, a composite breed containing Thoroughbred and other strains.



Most of the prominent families trace back to Rysdyk's Hambletonian, foaled in 1849 and descended from the Darley Arabian. No recognized breed contains greater variation in size, color, and character. Standard Breds are generally from 15 to 16 hands high, weigh from 900 to 1,000 pounds, and are bay, brown, or chestnut-colored. They are considerably sturdier and heavier limbed than the Thoroughbred. Selected entirely for speed, the American Standard Bred is naturally a trotter. (See HARNESS RACING.) Many, however, have been trained to pace. The trotting record for a mile on an oval track is 1 minute 55¼ seconds, the pacing record 1 minute 55 seconds.

The *Hackney* breed was established in England between 1750 and 1800 by mating Norfolk mares with Arab, Barb, Turk, and Thoroughbred stallions. Hackneys are primarily small carriage horses, sometimes used for riding but never for racing. They are noted for their high knee and hock action and their stylish gait. Most Hackneys stand about 15½ hands and weigh between 900 and 1,100 pounds. Chestnut, bay, and brown are the most popular colors; other colors are acceptable but not sought.

The average coach or carriage horse is a heavy harness horse, intended for drawing coaches and other vehicles. Among these horses may be mentioned the *French* and *German Coach* horses and the *Cleveland Bay*. The latter is the most popular in America but has never been widely distributed. It is 16 hands high, weighs from 1,400 to 1,500 pounds and, as the name suggests, is a dark bay color with black mane and tail. Action is essential in these horses, and this is usually imparted by crossing with the Hackney.

**Draft Horses** are heavy horses, developed for drawing loads. Consequently their conformation is distinctive. They have a massive, compact, and blocky body set on fairly short limbs. The muscles in the shoulders, loin, and thighs are heavy and adapted to slow but powerful contraction. The legs are developed so that the joints can bear the strain of pulling heavy loads; the large feet are strong enough to withstand continued impact on pavements. The *Percheron* was imported from LaPerche, France, in 1839. Its ancestry lies in the heavy Flemish horses, which were mated with the Arabs and Barbs brought to France during the Saracen invasion. This mating gave the Percheron the intelligence, activity, and docility which, combined with weight, excellent feet, and reliability, make it the most popular draft breed in the United States. Percherons are predominantly gray in color, stand 16–17 hands, and weigh 1,900 to 2,100 pounds. They are notably long-lived.

The *Belgian* also undoubtedly gets much of its basic blood from the Flemish horse but has little or no admixture of Arab. Horse breeding has for centuries been an important industry in Belgium, and the draft horse shows held in all parts of that country are subsidized by government prizes. Members of the breed are sluggish in temperament and well muscled, but the feet are often severely criticized because they are sometimes small and contracted at the heel. These horses approach the Percheron in size and weight. In color, however, they are roan or a dusty chestnut with flaxen mane and tail and have a white blaze on the face.

*Clydesdale* is the recognized draft breed of Scotland and was established by the Flemish stallions imported to that country. Scotch breeders stress the large, round, open feet, the flat, clean bone of the lower leg, and the mechanical accuracy of action. Clydesdales are somewhat smaller than the Percheron and Belgian breeds, standing approximately 16 hands high and weighing 1,800 pounds. The standard color is bay or dark brown with a white star or blaze on the face, and white legs feathered with long, fine hair below the knee. Because of the feathered legs, which are difficult to keep clean and dry, the breed has never achieved widespread popularity in the United States.

The *Shire* is the largest of the draft breeds, the average Shire standing 17 hands and weighing from 1,800 to 2,200 pounds. This heavy, feather-legged horse is a direct descendant of the "great" horses of the Middle Ages that were used by armored knights in combat. Today Shires are the chief farm horses of England, and their original black color has been largely replaced by bay and brown. They have never been especially popular in North America because of their extreme size, sluggish action, hairy legs, and flat feet.

The *Suffolk*, another draft breed, comes from the eastern part of England. It is a chestnut-colored horse, characterized by small ears, a broad forehead, a Roman nose, and a round, deep body that gives the animal a paunchy appearance. The legs are not feathered. These horses range from 15½ to 16 hands and weigh 1,600 to 1,800 pounds. They are chiefly farm animals.

**Mustang** is the name given to the so-called wild horses of western United States. These horses were really feral animals that escaped from the bands brought to this continent by DeSoto, Cortez, and other early explorers. Some mustangs were captured and tamed; others, known as *brancos*, were untamable. Mustangs are still found today on the western plains. The introduction of Thoroughbred and Arabian blood has produced strains with greater size, more speed, and improved appearance, and the rugged existence of these feral bands has made them hardy and sure-footed to a remarkable degree.

**Ponies** are horses of any breed that stand under 14½ hands. The most popular pony in the United States is the *Shetland*, which is actually a small draft horse. These ponies stand about 10 hands high and weigh less than 200 pounds. The heavy, woolly coat varies in color from white to black. Their popularity as pets and playmates of children is attributable to their gentle and playful temperament. *Welsh* ponies are somewhat larger than Shetlands, ranging from 12½ to 14½ hands. They show style and action, and serve for either riding or driving. *Hackney* ponies are not a special breed but are so classed when they stand less than 14½ hands.

**Mules** are hybrids produced by mating a jackass with a mare and cannot become a distinct breed because they are infertile. They are more popular in the United States than in any other country, many types of mules having been selected for special uses. Their ears are long, the body slender, the tail tufted, and the feet small. Mules are quiet and patient by temperament, possess remarkable endurance, and are exceptionally resistant to disease. See HINNY; MULE.

R. E. M.

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**HORSE CHESTNUT**, or **BUCKEYE**, a genus of large trees belonging to the family *Hippocastanaceae*.

#### Horse chestnuts visible in opened pods

L. W. BROWNELL





L. W. BROWNELL

Winter Buds of the horse chestnut tree

These trees grow to a height of 100 feet, have spotted flowers, and fruits that are prickly brown pods, each containing one large seed. Many species of horse chestnut are grown as shade trees or as ornamentals throughout the north temperate zone extending from the United States south to northern South America. A few species yield a limited supply of commercial timber, the soft wood being used in the manufacture of boxes, excelsior, and cheap furniture. The species most common in the United States is *Aesculus Hippocastanum*.

**HORSE LATITUDES**, at sea, are belts or cells of high atmospheric pressure, located generally about 35° N or S lat. following the sun's migrations north and south. Prevailing westerlies with lower pressures are on the poleward sides and the trade winds on the equatorial sides. Light variable winds (sometimes gales) and clear skies prevail. The name "horse latitudes" is said to have originated because of the variable and hazardous weather encountered in the lanes of sailing ships carrying horses to the West Indies. They sometimes ran short of water, and some or all of the animals had to be jettisoned. See **DOLDRUMS**.

**HORSE MACKEREL**, a member of the pompano family *Carangidae*, which includes a large number of powerful predatory marine fish, useful as food, and widely distributed over the oceans of the world. The name properly belongs to the scad, *Trachurus trachurus*, a species of the European coasts, but is given in the United States to the tunny occasionally off the New England coast; also to a fine fish, *Carangus hippos*, known in the Gulf of Mexico as "cavalla" or "jack"; and sometimes to such allied species as the valuable runner or hardtail, *C. chrysos*. Another West Indian species, *C. latus*, reputed poisonous, is known as horse-eye jack.

**HORSE MESA DAM**, Arizona. See **DAM**.

Horse chestnut tree in flower

J. HORACE MCFARLAND CO.



## HORSE RACING ♦ Sport of Kings

*Since the first Virginia race meeting in 1753, horse racing has been a popular sport in America*

**HORSE RACING.** There were trials of speed and endurance between horses centuries before the Christian Era, but the animals were driven in chariots. Homer (*Iliad*, xxiii) gives a graphic description of such a race. The Greeks set apart certain races to be run by colts, and others by fillies, of the same age. But the sport, as we know it, did not become popular until its rise in Britain during the reign of James I. Newmarket had become a center for the sport even before that. Epsom, or Banstead Downs, as it was long called, also became the scene of race meetings. In Queen Anne horse racing again found a patron, and she was the first to give royal cups, to be run for at the northern meetings only. See **DERBY**, **ENGLISH**.

**America.** It was later, in the reign of George II, in 1730, that the race horse made his appearance in America, the English horse Bulle Rock, foaled in 1718, being imported into Virginia by Samuel Patton and Samuel Gist, and beginning the era of the many race horses which were to make their names felt in the early history of the colonies. It was the cavalier of England who brought the race horse to America, and as the men of his type had settled in Virginia that colony was the fountain head of racing in America. For 50 years the racers were imported from time to time, bred to American stock, and Virginia and Carolina furnished the competitors at the various contests. Virginia was also the mother of the "four milers," and though contests at that distance and at four miles and repeat were seen in England, it was in America that such races were considered the true test of a horse, contrary to the English opinion, and the four-mile-heat race horse was the king of his day for nearly a century.

The first race meetings in America were given in Virginia in 1753, and the first regular racing organization was formed at Charleston, S.C., in February, at the Newmarket Course. At about the same time there were the Newmarket, Tree Hill, Broad Rock, and Fairview courses in Virginia. All of them were the center of social life, General Washington acting as judge at one of the Newmarket meetings. Annapolis and Baltimore also had race tracks within a short time afterward. The records of the meetings at these tracks are fragmentary, although there are many accounts of races for rich stakes and bets. By the time of the Revolution the breeding of race horses had progressed so far that stud farms were in existence from Long Island to the Carolinas and many horses were bred and raced. During the war little was done, but after the surrender of Cornwallis the turf again began to flourish in Maryland, Virginia, and the Carolinas, though it was not until some years later that the turf in the North had reached the respectability of the turf in the South, and it was not until 1815 that the race meetings of America were conducted on anything like systematic plans.

Since that time the records have been regularly kept and are authentic. Prior to that time the records are fugitive and cannot be used as an authentic history of the American turf. Among the owners and patrons of the turf in the 18th century were Col. William Alston, Gen. George Washington, John Randolph of Virginia, and Gen. Wade Hampton, and a host more who flourished in the beginning of American turf history. The breeding farm of Wade Hampton, the son of General Hampton, for instance, contained in 1842, 17 fillies and mares and six colts imported from England from 1835 to 1838, while there were five native and three imported mares bred yearly.

**Early Racing in the North.** The first Thoroughbreds imported into the North were the horses Wildair



and Lath. The Cub Mare and Rachel landed at the Battery in New York City between 1755 and 1760, and to the Cub Mare many high class racers of today can trace their ancestry. The first races in the North were held on Long Island in 1819, and in 1821 the famous Union Course was laid out there. It was on the Union Course that many memorable contests between the North and the South were decided, notably the great Sir Henry-Eclipse match in 1823. Kentucky began the breeding of race horses in 1795 and Tennessee in 1800, and soon after they were rivaling the older states. As the years went on Kentucky firmly established herself at the head of the states in this respect. The great Boston was bred in Virginia, but his still greater son, Lexington, came from the blue grass region of Kentucky, and there are few who will deny that he was the greatest race horse ever bred in this country. See DERBY, KENTUCKY.

**Late 19th Century.** From 1870 to 1880 came the passing of the "four miler" and in his place appeared the sprinter, or the one heat racer, and within a decade the long-distance heat-runner had disappeared from the American turf as he had years before in England. During the Civil War racing in the South was paralyzed, although occasional meets were held. In the very heart of the war, in 1863, the North took up racing in earnest and Saratoga's famous track was opened for the first time with the famous wit and sportsman, William R. Travers, as its president. Jerome Park followed in 1866 and then in the following years Monmouth Park, Brighton Beach, Sheephead Bay, Brooklyn, Morris Park, Aqueduct, Jamaica, and finally in 1905 the magnificent Belmont Park on Long Island, built to succeed Morris Park, which had taken the place of the abandoned Jerome Park.

Meanwhile a wave of public sentiment against racing was sweeping across the country and in state after state the sport was prohibited until only in Kentucky and Maryland was it legal. New York was the last state to feel this public resentment. The Hart-Agnew law was passed by the legislature in 1908, so modifying the Percy Gray law under which racing has been operating that the operators of the tracks abandoned the sport in 1910. In 1913 they again operated under the oral betting system and continued to do so until the law establishing the present racing commission and legalizing betting went into effect in 1934.

**Revival of Racing.** Long before this racing was regaining its lost prestige. In 1911 a state racing commission was formed in Kentucky with mutuel betting permitted, and in 1917 Maryland adopted a commission to govern the sport in that state. Racing prospered so and paid such high revenue to the states that other states began to legalize mutuel betting. Illinois came back under a state racing commission in 1926 and under its jurisdiction there was a revival of many of the time-honored stakes that had been run previously.

Until state racing commissions came into being the sport had always been governed in the United States by the Jockey Club, whose rules were adhered to wherever there was racing. Their rules covered the suspension and ruling off the turf of owners, trainers, jockeys and other persons and none could be reinstated without the consent of the Jockey Club. It was under the Jockey Club that the turf sport became well organized and that reforms were made that en-



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### "They're off!" Horses leave starting gate in race

couraged honesty and protected the public.

The racing commissions, operating under laws of their separate states, have encroached on the powers of the Jockey Club until now that body is no longer in control of the turf. It still retains the power to grant licenses and suggest racing dates for New York and because of this still wields a strong influence over racing practices in other states through its power to refuse licenses.

The great growth of racing started after 1920 with the greatest boom after 1934. Twenty-five states permit betting on the races, and parimutuel betting is legal in 24 states. Bookmaking, an illegal form of betting, came under scrutiny of the U.S. Senate's committee investigating crime (the Kefauver Committee) in 1950-51, and was linked with crime syndicates, flourishing on a national scale. See GAMBLING.

Winter racing, which for years was confined to New Orleans, assumed major proportions in 1931 when Florida adopted the mutuels, followed in 1936 by California. Now rich stakes attract the best horses to the sunshine states with the \$100,000 Santa Anita Handicap and the \$100,000 Santa Anita Derby, run at Santa Anita track in California. In Florida the Widener Challenge Cup, worth \$50,000 and run at Hialeah Park, is the second largest of the winter stakes. These events serve to keep the sport on a level with that of the North during summer.

The growth of racing has brought about more stringent regulation. The saliva test to detect the doping of horses has become almost universal. It has had a marked effect in reducing the practice of stimulating, an evil that caused a good deal of dishonesty. Other improvements have been the adoption

### "Assault," with Eddie Arcaro up



of cameras to decide close finishes. These are generally in use now and have been found far more accurate than the eye of the placing judge. The stall gate for starting, now in general use, is an acknowledged improvement over previous methods of getting horses away. Increasing profits have resulted in the building of expansive stands, ornate and commodious.

With the increase in purses for the better grade of horses have also come changes for the racers of less ability. The selling race has been supplanted by the claiming race and the conditions so clarified that they have been universally adopted. A horse may be entered for the price stated in the conditions with an allowance of weight off if entered for a lower price within limits. This enables the owner to make his own handicap. The winner may be claimed for the entered price, plus the value of the purse.

**Famous Race Horses.** The American turf has produced many great horses but the laurels appear to rest with modern times. Until 1919 Colin was the outstanding performer. He won 15 races in the seasons of 1907 and 1908 and was retired undefeated, to become a valuable sire. In 1919 Man o' War, a chestnut son of Fair Play and Mahuba came to the races to establish himself as the greatest product of the American turf, a distinction he long held, and to be generally known as the horse of the century. Man o' War raced 21 times and was defeated but once. This occurred in the Sanford Stakes at Saratoga in 1919 when he was a two-year-old and after he had suffered several mishaps. That year he won the Hopeful and the Futurity, two most important juvenile stakes, among others. In the following year he swept through all opposition as a three-year-old. Though not started in the Kentucky Derby he won the Preakness, the Belmont, Lawrence Realization and most of the other fixtures for horses of his age, 11 in all, and displayed his speed over distances ranging from a mile to a mile and five-eighths. In the course of these races he set five American track records and two world records. They were for a mile and three-eighths in 2:14 $\frac{1}{5}$  in the Belmont Stakes and for a mile and five-eighths in the Lawrence Realization in 2:40 $\frac{1}{5}$ . He was retired with total earnings of \$249,465.

The same period developed America's greatest cup horse, Exterminator, owned by Willis Sharpe Kilmer. Exterminator started 100 times in a period of eight years of racing and won 50 times for total earnings of \$252,996. He won the Kentucky Derby as a three-year-old but made his place in turf history later by winning numerous cup races over distances up to two and a quarter miles and was retired at the end of the 1924 season. The record for the greatest money earnings in the world was long held by Sun Beau, also owned by Kilmer. From 1927 to 1931 inclusive he won \$376,744 to displace Isinglass, an English horse that had long held the money winning record. A failure as a juvenile he improved as he grew older, his closing year being the best. He started 74 times and won 33 races. Among the leading money winning horses of the world (as of Jan. 1, 1950) were: Stymie (131 starts) \$918,485; Citation (29 starts) \$865,150; Armed (75 starts) \$809,950; Assault (39 starts) \$672,520; Whirlaway (60 starts) \$561,161; On Trust (61 starts) \$497,920; Seabiscuit, grandson of Man o' War (89 starts) \$437,730; First Fiddle (95 starts) \$398,610; Coaltown (28 starts) \$380,775. Citation became (before his retirement in 1951) the first race horse to earn over \$1,000,000.

The fastest mile ever made on an elliptical course was run by Citation at Albany, California, in 1950, when he covered the distance in 1:33  $\frac{3}{5}$  to set a new world record. Previous records were: Man o' War (1:35  $\frac{4}{5}$ ), later lowered by Jack High (1:35), Equipoise (1:34  $\frac{2}{5}$ ), and Coaltown (1:34). The fastest straight mile was run in 1939 by Mopsus, a British horse, who ran the distance in 1:32  $\frac{4}{5}$ .

The highest price ever recorded for the sale of a single horse was \$640,000, which a syndicate reportedly

paid Frederick Myerscough, Irish sportsman, for his horse, The Phoenix, in 1948. Other record amounts for sires include: \$500,000 for Alibhai (English); \$448,000 for Stardust (Eng.); \$400,000 for Ardan (Fr.); \$265,000 for Tracery (U.S.A.) and \$250,000 for Challedon (U.S.A.). Record prices paid for yearlings include: \$117,600 for Sayajirao (Eng.); and \$75,000 for New Broom (U.S.A.). See PARI-MUTUEL BETTING.

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**HORSE-RADISH**, a cruciferous plant cultivated in Europe, but in America a garden-escape, frequent in moist lands. The root of the horse-radish, *Armoracia rusticana*, which has a hot, piquant, mustard-like taste, is grated as a condiment eaten with meats.

**HORSEFLY**, any of the well-known flies of the family *Tabanidae*. The more common horseflies belong to the genus *Chrysops*; other larger species are members of the genus *Tabanus*. These insects are powerful fliers, being able to overtake even the swiftest of horses. They deposit their eggs on aquatic plants or on exposed stones in a stream. The larvae are predaceous and at least partially aquatic. Male horseflies feed upon nectar, while females suck the blood of man and domestic animals.

**HORSEHAIR WORM.** See **HAIRWORM**.

**HORSEMINT**, a genus of perennial herbs belonging to the Mint family, *Labiatae*. True horsemint, *Monarda punctata*, has downy leaves and yellowish flowers, while *M. mollis*, a tall branched plant, has pink or lilac flowers. Both species grow best on sandy grounds and dry plains. Oswego tea, *M. didyma*, and wild bergamot, *M. fistulosa*, are also members of the horsemint genus.

**HORSENS**, seaport, Denmark, in E Jutland, Aarhus County, on Horsens Fjord; 32 miles SW of Aarhus. It has a 13th-century church and a castle. The chief industries are textile weaving, ironworking, shipbuilding, and the manufacture of tobacco products, electrical supplies, and organs. Large quantities of dairy products are exported. Pop. (1945) 32,400.

**HORSEPOWER.** The word "horsepower" has become familiar to everyone in these days of mechanization. Back of this word lies a story that is intimately tied up with human progress.

The cave man, who first tied a flint to a stick and used it as a hatchet, made a fundamental invention that is just as important today as it was then. As evidenced by our hammers, hatchets and axes, he was trying to extend the use of his muscle through increased leverage. Man has extended all his faculties—the telescope and microscope extend vision, the telephone and loud speaker increase the range of his voice and the keenness of his hearing, and transportation has widened his activity in every direction. One of his earliest advances in extending his power was when he domesticated animals and used his little muscles to control the big muscles of animals such as oxen, horses, and elephants. And he has been using his brain and smaller strength to control much larger forces ever since.

In the average home a hundred years ago a good housekeeper had to do a lot of work by hand—there were fires to be made, water to be pumped, clothes to be scrubbed and ironed, carpets to be dusted and floors polished—not to mention the various forms of hand labor involved in getting a meal. The modern housewife, on the other hand, would be envied by any ancient ruler with his coterie of slaves for by turning switches she can control enough horsepower to do all this work with what we might call electrical slaves and these are at her beck and call day or night. This power, available for the household, does not include the 150 hp car in the garage that can transport her many miles to town and back, run errands, get the





# HORSEPOWER

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groceries and take the children to school or the family to church.

The operator of a steel mill by moving a tiny lever can command 5,000-10,000 hp to roll out huge steel billets. And the pilot of a modern bomber controls over 20,000 hp with the movement of his hand.

Just as Watt's steam engine heralded the Industrial Revolution, the internal combustion engine changed the pattern of civilization, particularly for the individual. It provided him with personal transportation for his daily needs and put him in touch with other people and events in many different parts of the country. All he needed was a road to travel on and this was quickly provided.

America's leading position in the world today is no mere accident. This country has surpassed every nation in the world in the production and utilization of power.

If we use this power wisely—to build instead of destroy—we can accomplish miracles for peace and progress. See POWER.

CHARLES F. KETTERING

**Horsepower, as a Unit**, associates force and time, an equivalent to the lifting of 33,000 lbs. a distance of one foot in one minute (33,000 ft. lbs. per min.) or 550 ft. lbs. per second. This unit was devised and so named by James Watt during his first attempts to persuade mine owners to substitute his steam engines for horses in lifting coal. To err on the conservative side his "horsepower" was actually equal to half

again as much power as an average horse could deliver. The term *horsepower-hour* is applied to the energy furnishing the horsepower rate over a period of one hour, and a steam power plant of high efficiency can do this on a little more than one pound of good coal.

*Indicated Horsepower* is that calculated by means of an indicator or precalculated by the designer. *Brake Horsepower* is the measure of horsepower actually delivered by the engine while working against a Prony brake or dynamometer. In electrical units 0.746 kilowatts is approximately equal to one horsepower. See DYNAMOMETER; INTERNAL COMBUSTION ENGINE; STEAM ENGINE; POWER PLANT; POWER; AUTOMOBILE; MOTOR TRUCK.

**HORSESHOE**, a rim of iron or steel, U-shaped to fit around the outer edge of a horse's hoof, for the protection of which it is securely fastened with nails. Although the hoofs of horses were clumsily "shod" with "sandals" filled with straw and other cushioning materials in ancient Greek and Roman times (and in the Far East are still sometimes so protected) *nail shoes* were not introduced until 300-200 B.C. The Huns rode on shod horses, the horses of Charlemagne were shod with iron shoes, and by the Middle Ages horseshoeing similar to that of modern times was not uncommon in Europe. William the Conqueror is thought to have carried the custom to England. The horses of royalty were occasionally shod with shoes of gold for special ceremonial events, and horseshoes

**Horsepower** originates from generators, condensers and other power-creating machines such as those shown at the left. The modern housewife can control this power to work for her in the kitchen

WESTINGHOUSE

GENERAL ELECTRIC CO.



appear on the coats of arms of the nobility, some of whom learned enough of the art of the *farrier* (horse-shoer) to shoe their own favorite mounts.

Shoeing played an important part in the development of the draft horse, the hunter, the thoroughbred, and other types. After the construction of surfaced roads and paved streets, horseshoeing became a vital and specialized trade which did not decline in importance until the era of the automobile and truck. Frequent allusions to the horseshoe and horseshoe nail have been made in literature; in popular superstition, horseshoes have long been a symbol of good fortune, particularly when fastened open end up above doorways to keep the "luck" from running out.

Early horseshoeing was often inept by modern standards, with unnecessary injury to the horse's feet and a consequent harmful effect on his health in general. In modern times, veterinary science has steadily improved the design and balance of horseshoes themselves and the technique of their application. Even the animal's idiosyncrasies of gait are taken into consideration by the modern farrier. Horseshoes vary in weight from the three- or four-ounce plate of the thoroughbred to the heavyweight shoe of the work horse, calked at heel and toe for a more secure foothold on slippery surfaces. W. P. S.

**HORSESHOE CRAB.** See KING CRAB.

**HORSESHOE FALL.** See NIAGARA RIVER, *Niagara Falls*.

**HORSESHOE PITCHING**, or **Horseshoes**, like quoits, is derived from the ancient Greek sport of discus throwing. The heavy discus became the lighter quoit, a discus shaped missile with a hole in its center. The discus throwers threw for distance; the quoit throwers threw at a mark for accuracy. Horseshoes were probably used as quoits as soon as the metal shoes were developed, probably before 200 B.C. The game of quoits, still popular in the British Isles, is virtually obsolete in the United States, except as a modified indoor game. But horseshoes, once a purely rural sport, has achieved nationwide popularity. Most cities and towns have parks or playgrounds with horseshoe courts, many of them equipped with lights for night playing. The standard court is 50 feet long by 10 feet wide with a stake at each end. The stake is a steel or iron bar, one inch in diameter, driven into the earth and extending 12 inches above the surface. It is slanted 3 inches from the perpendicular toward the opposite stake. The metal horseshoes must weigh no more than 2½ pounds. They shall be no more than 7½ inches long or 7 inches wide. The open end shall be no more than 3½ inches, inside measurement. The players take turns tossing the shoes toward the stakes. The shoe closest the stake counts 1 point. If both shoes tossed by a player are closer than those of his opponent, he scores 2 points. A "ringer" is a shoe encircling the stake. It counts 3 points; 2 ringers, 6 points. If each player has 1 ringer or if each has 2, they counteract each other and no score is counted. A shoe more than 6 inches from the stake is a foul and is not counted. The first player to score 50 points wins the game. In tournament play, the first player to win 6 games out of 11 or fewer, wins the match.

In quoits the stake protrudes but 1 inch above the ground. The iron quoits, flat on the bottom, and rounded on the upper surface, weight about 9 pounds each. The nearest quoit to the stake counts 1; a ringer, 2. A quoit must land within 18 inches of the stake to be counted. Quoits landing on the top or rounded surface are not counted in scoring. H. M. BEARDSLEY

**HORSETAIL**, a genus of flowerless plants belonging to the family *Equisetaceae*. These plants, native to north temperate regions, are generally distributed in wet, marshy ground, and dry, sterile soils, especially along railways and roadsides throughout the United States. They have a creeping rootstock with vertical, jointed stems and small leaves arranged in whorls. The first stems to appear are fertile, usually un-



CHICAGO NATURAL HISTORY MUSEUM

**Fossil horsetail of Pennsylvanian period**

branched, and bear terminal sporangial cones. They are pale brown, each stem bearing 6 to 10 yellowish sheaths, one inch in length and flared outward at the tops. The spores are grayish-green and have two straplike appendages, elaters, attached to their midline. These appendages coil about the spores when moist but upon drying they straighten out crosswise, entangling the spores in dense groups. The sterile stems appear after the fertile stems, and are green and profusely branched, often resembling miniature pines.

*Equisetum arvense*, field horsetail and *E. palustre*, swamp horsetail, are the most common species in the United States. Some unusual tropical species attain a height of 30 feet but most species do not exceed a height of four feet. *E. hymenale* contains silicates in its rough stems, and has been used as a scouring-rush, by which name it is commonly known.

Some horsetails, especially *E. palustre* and *E. arvense*, are poisonous to stock. Poisoning occurs mainly when these rushes are mixed with hay. In grazing, the stock apparently avoid eating horsetails. Stock poisoned by horsetails exhibit extreme nervousness followed by exhaustion and death.

Horsetails, like the closely related ferns, were extremely abundant and diversified in the Carboniferous period, and grew to great size. Well-preserved fossil horsetails are commonly found in coal strata. See PTERIDOPHYTES.

**J. P. C. HORTA**, town, the Azores, on the SE coast of Fayal Island, capital of an administrative district made up of the islands of Pico, Flores, Corvo, and Fayal. Horta is the headquarters for local whale, tunny, bonito, and mullet fisheries and exports sperm oil, grain, and wine. It is a base for transatlantic commercial flights and during World War II was a British and American air base. Pop. (1946 est.) 10,500.

**HORTEN**, seaport, Norway, Vestfold County, on the W shore of Oslo Fjord; 66 miles S of Oslo. It is practically one with Karl-Johansvaern, headquarters of Norway's fleet. The town has an observatory, a naval academy, a nautical museum, an arsenal, and shipbuilding yards. During World War II effective resistance was made here when the Germans attacked in April, 1940. Several ships, including the *Blücher*, the *Gneisenau*, and the *Emden*, were damaged. The port was liberated from German control in May, 1945. Pop. (1946) 10,775.

**HORTENSE**, born *Hortense de Beauharnais*, 1783-1837, queen of Holland, daughter of Joséphine Beauharnais by her first husband, was born in Paris. She married (1802) Napoleon's brother, Louis Bonaparte, king of Holland, and on the downfall of the dynasty (1815) fled to Switzerland. The youngest of her sons became NAPOLEON III.



**HORTENSIVS, QUINTUS**, 114–50 B.C., was perhaps, after Cicero, the most famous orator of ancient Rome. He belonged to the aristocratic party, and supported Sulla in the civil wars, and in later life found scope for his talent chiefly in defending aristocrats when on trial for misgovernment or other offenses. He was quaestor in 81, aedile in 75, praetor in 72, and consul in 69 B.C.

**HORTHY DE NAGYBANYA, NICHOLAS**, 1868–1957, Hungarian admiral and regent. He entered the Austro-Hungarian navy and served as A.D.C. to Emperor Francis Joseph. He commanded a cruiser during World War I and fought against the Italian fleet. Later, as commander in chief, and after the war, he threw himself into the counterrevolution and aided in the establishment of the Karolyi government. In command of the national army, he succeeded in crushing the Bolshevik movement in his country and was elected regent of the kingdom (without a king) in 1920. When the deposed Emperor CHARLES attempted to assert his right to the Hungarian throne, Horthy captured him and handed him over to the Allies, who conveyed the monarch out of the country. Charles was then legally dethroned and Horthy paradoxically became regent in a nonroyal state. In July, 1933, a law was passed empowering the regent to prorogue or dissolve parliament at his own discretion. In July, 1937, the regent was legally released from all responsibility to parliament, his power becoming absolute. Horthy collaborated with Hitler who enabled Hungary to regain some territories lost at the end of World War I. Abducted by German spies, he consented to the occupation of Hungary by the German army (1944). When, with the Russian army approaching Budapest, Horthy asked for an armistice, he was deposed by Nazi sympathizers; with the Russian occupation of Hungary, he fled into Germany. There, he was tried for war crimes, and released (1946).

**HORTICULTURE**. See GARDENS AND GARDENING.

**HORUS**, the name given an Egyptian god who is represented in a number of distinct forms, all of which are associated with the symbol of the sacred falcon. The god appears very early in Egyptian mythology, and upper Egypt considered itself under his patronage. Horus was associated with the sun and was regarded as the offspring of Isis and possibly Osiris. He has been identified with the Greek god APOLLO and the Egyptian deity Harpocrates, who was represented with his finger upon his lips and worshiped in Rome.

**HORVÁTH ORSZÁG**. See CROATIA.

**HOSANNA**, the usual cry of marching processions in Jerusalem, used when Jesus made his triumphal entry into Jerusalem (Mark 11:9, 10).

**HOSEA**, one of the 12 minor prophets and the writer of the Old Testament book which bears his name. In Rom. 9:25 he is called Osee. He is thought to have been a native of the northern kingdom of Israel, and his prophecies belong to the period of the reigns of Jeroboam and his successors (between c. 747 and c. 722 B.C.). His writings deal almost entirely with the kingdom of Israel in which idolatry flourished, although the country had prospered materially under the reign of Jeroboam II.

The book of Hosea may be divided into two parts: (1) Hosea tells of his own tragic marriage and uses it to illustrate the sinful state into which Israel has fallen in turning from the true worship of Jehovah to idolatry. The reunion of Judah and Israel are predicted in this section, which includes the first three chapters. (2) Hosea describes in more detail the infidelity of Israel as revealed in its idolatry, its internal corruption, and its relations with other nations. He pronounces judgment on both Israel and Judah but promises deliverance from doom if Israel repents for its sinfulness. This section includes chapters 4 to 14.

The style in which Hosea is written is highly poetic, the prophet making use of images, comparisons, and

metaphors, but at times it is rather disconnected and difficult to follow. Hosea's conception of God's love for his chosen people is analogous to the Christian view of the fatherhood of God as it is developed in the New Testament. He has sometimes been called "the weeping prophet of Israel," having a similar position to that of Jeremiah, who has been referred to as "the weeping prophet of Judah." See BIBLE; OLD TESTAMENT.

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## HOSPITALS

*Where competent medical and surgical care is dispensed to the ill or injured*

**HOSPITAL**. A hospital has been defined as any institution that maintains and operates facilities for the diagnosis, treatment, or care of two or more non-related individuals suffering from illness, injury, or deformity; or in which obstetrical or other medical or nursing care is rendered to such individuals; and wherein any such individuals are resident for a period exceeding 24 hours.

The organization of hospital service in the United States began about the middle of the 18th century. The course of development paralleled the flow of population, first along the eastern seaboard and Gulf of Mexico, and later along the inland waterways and other routes of transportation and commerce. By 1842 there were approximately 50,000 beds available for hospital care. When the first complete hospital list was prepared by the American Medical Association in 1909, there were 4,359 hospitals in existence with a combined capacity of 421,065 beds. By 1929 the total bed capacity had increased to 907,133; by 1939 to 1,195,026. In 1949, 6,572 hospitals registered by the American Medical Association reported 1,439,000 beds, 16,659,973 admissions, 2,820,791 births, and an average daily census of 1,224,951 patients.

**Kinds of Hospitals**. On the basis of the type of service they provide, hospitals may be classified in two groups. *General hospitals* admit patients with all types of diseases. The general hospitals are the chief source of hospital service in the United States, comprising 4,761 institutions with a total capacity of 574,683 beds. In 1949 these institutions had over 15,400,000 admissions. *Special hospitals* include nervous and mental institutions, tuberculosis sanatoriums, maternity hospitals, and other specialized services relating to cancer, industrial medicine, eye, ear, nose and throat, fractures and orthopedics, pediatrics, contagious diseases, convalescence, and rest. The principal units in this group are the mental hospitals and the sanatoriums for tuberculosis. Approximately 675,000 patients were under treatment in hospitals for mental diseases in 1949, mostly in institutions under state control. The problem of tuberculosis hospitalization and control is of considerable magnitude, as evidenced by an annual admission rate of some 113,000 patients and a daily sanatorium load of approximately 70,000.

On the basis of ownership or control hospitals may be divided into two classes. *Governmental hospitals* include Federal, state, county, municipal, and city-county hospitals, all operated and controlled by the respective government agencies. The Federal institutions may be further subdivided into hospitals maintained by (1) the Army, (2) Navy, (3) U.S. Veterans Administration, (4) U.S. Public Health Service, and (5) Indian Administration. The governmental hospitals, which total 1,937, had in 1949 a capacity of 1,025,155 beds. They reported 4,258,785 admissions and an average daily census of 915,843.

*Nongovernmental hospitals* include two groups. *Proprietary hospitals*, whose maintenance is dependent entirely on the income from patients, are individually



PAUL PARKER

### New York Hospital and Cornell Medical Center

owned or operated as partnerships or corporations unrestricted as to profit. *Nonprofit organizations* include church hospitals and other nonprofit associations. While their principal income is usually from patients, their community service may also be extended by gifts, donations, subscriptions, or income from endowments, community funds, or other sources. In recent years the development of voluntary hospital insurance plans of various types has been a great aid to patients in the financing of hospital costs, for which budgetary allowances are not always made. The Blue Cross Plans, sponsored by the American Hospital Association, and operating on a nationwide basis and throughout Canada, had approximately 41,000,000 members in 1951.

**Training Centers.** Many auxiliary functions that play a significant role in the development and maintenance of high standards of hospital service are educational in character and relate to the training of medical, nursing, technical, and other hospital personnel. Many hospitals are associated or directly affiliated with medical schools. After graduation the young physician enters an internship, which may later be followed by one to three years of specialty training. More than 1,800 hospitals offer approved internships or residencies in accordance with standards established by the American Medical Association. About 1,100 hospitals maintain accredited schools of nursing education, which provide training for nearly 100,000 student nurses. A considerable number of hospitals are also participating in the training of x-ray, laboratory, physical therapy, and occupational therapy technicians and medical record librarians. The Council on Medical Education and Hospitals of the American Medical Association has developed standards for the approval of technical schools in these fields, except nursing.

### Billings Hospital, University of Chicago

KAUFMANN &amp; FABRY CO.



**Staff.** The hospitals in the United States employ 199,295 graduate nurses exclusive of private duty assignments; 150,000 practical nurses and attendants; 58,000 nurses' aides; 25,000 orderlies, and about 25,000 ward maids.

In addition to this personnel, there are the laboratory technicians, x-ray technicians, dietitians, physical therapy technicians, pharmacists, medical record librarians, medical stenographers, occupational therapy technicians, nurse anesthetists, and general maintenance workers.

Quality of medical service is the most important factor in the care of hospital patients. Standards of the American Medical Association and the American College of Surgeons require that staff physicians have satisfactory qualifications as to training, licensure, and ethical standing, and that they be proficient in the fields of practice to which they devote themselves. According to the American Medical Association, there were, at the end of 1949, 201,278 doctors in the United States.

**Administration.** The administrative control is usually vested in a board of directors, board of trustees, or other governing body that has final authority in all matters relating to hospital service. The medical executive represents the staff in the formulation of medical policies, acts as an advisory body to the governing board, and assumes responsibility for the quality of professional service in the hospital. The actual authority of administration is ordinarily delegated to a chief executive officer known as hospital administrator or superintendent, who in turn is directly responsible to the governing board. He has charge of personnel, equipment, and supplies and is responsible for the efficient operation of individual departments. In all administrative activities there is close correlation with the professional division. All efforts therefore, can be directed jointly to the further development of hospital standards and the continued maintenance of high quality of patient care.

FRITJOF H. ARESTAD, M.D.

**Construction.** In Europe the pavilion type of hospital is common, providing an aggregation of self-contained units, one for each specialty. In the United States the skyscraper or vertical type has been found much more economical and convenient, even in rural districts. Fine examples of this type are the Presbyterian Hospital in New York City and the University Hospital at Ann Arbor, Mich. The physical structure of modern hospitals is changing to provide accommodations comparable to those found in modern hotels. A homelike atmosphere is created by restful color schemes for walls, curtains, rugs, lamps, screens, etc. The most suitable flooring material is terrazzo or rubber tile; walls are glazed or covered with a non-porous paint. Furniture is as simple as possible and constructed of metal or close-grained wood.

Hospital facilities are usually measured in terms of beds. There is no rule as to the cubic feet of hospital mass for each bed, since private room service consumes more space than ward service, and differentiation of clinical departments increases service space. In the United States carefully planned general hospitals range from 8,000 to 16,000 cubic feet for each bed. Local legislation allows a minimum of 800 cubic feet per bed in public wards. Plans often provide for a number of small wards leading from common corridors, in order to satisfy the environmental needs of different types of cases.

Many of the states regulate hospital location and building through their housing codes, licensing requirements, and zoning laws; some require that plans be submitted to the board of health or state fire marshal. Most cities have detailed requirements as to location, construction, materials, fire and sanitary regulations. Many states and cities require the licensing of certain institutions for purposes of revenue or registration, or to enforce standards of housing, maintenance, care, location, etc.



**Early History.** The rulers of India, Persia, and Arabia maintained hospitals in very early times; and the healing art was practiced in the temples of ancient Egypt, Greece, and Rome. Medical schools were conducted in connection with the early Egyptian temples, and Egyptian physicians are said to have held clinics there centuries before the time of Christ. In Greece, and later in Rome, the temples of Aesculapius were the chief houses of healing. To them the sick made pilgrimages to render their offerings to the god and to place themselves under the care of the priests. There they were accustomed to spend the night, in the hope that their dreams might reveal to them the treatment they should follow. The House of Sorrow for the care of the sick and wounded was founded in Ireland in 300 B.C.; King Asoka of India established hospitals throughout his dominions about 260 B.C.; and the Roman senator Antonius erected buildings for the care of the dying and for lying-in women about A.D. 170.

**Impact of Christianity.** With the general recognition and spread of Christianity, hospitals multiplied. Fabiola, a pious and wealthy Roman matron, established one near Rome in 380; St. Basil founded the great hospital at Caesarea, with separate provisions for lepers, in 369; and Pope Symmachus built hospitals and homes for the poor of Rome in the late fifth and early sixth centuries. In the first half of the seventh century hospitals were founded by St. John the Almsgiver at Alexandria, by Bishop Brassianus at Ephesus, and by St. John Chrysostom, St. Pulcheria, and St. Sampson in Constantinople. The first hospital in France belonged to the sixth century. The Hotel Dieu in Paris, the oldest hospital in existence today, dates from about 660.

During the Middle Ages practically all of the monasteries had some provision for the care of both cloistered patients and strangers, one of the most famous of these being the Benedictine Abbey of Cluny, established in 910. During this period, also, there were organized various confraternities and religious orders for ministering to the sick, notably the Knights Hospitallers in the crusading era, and the Order of the Holy Ghost founded by Guy of Montpellier. Privately endowed hospitals first appeared in Italy, where a number of such institutions were in existence as early as the 12th century.

**British Isles.** In England the first hospital of which there is record was founded by the Archbishop of Canterbury in 900. Hospitals and charitable institutions increased rapidly there, as on the Continent, during the period of the Crusades. Among London hospitals St. Bartholomew's was founded between 1123 and 1133, and re-established on a secular basis by Henry IV in 1544; St. Thomas' was established in 1215, and re-established in the reign of Edward VI; and Bethlehem was founded in 1547. Westminster dates from 1719; Guy's from 1725; the Lock from 1746; St. George's from 1733; the London from 1740; Middlesex from 1745; and University College from 1833. The Royal Infirmary of Edinburgh was established in 1730.

**America.** In the United States the earliest hospital was erected on Manhattan Island in 1663 to care for the soldiers and Negroes of the East India Company. The oldest now in existence is the Pennsylvania Hospital, dating from 1751, which grew out of the medical work begun at the Philadelphia almshouse 20 years earlier. In New York City, the New York Hospital dates from 1771, Bellevue from 1811, St. Vincent's from 1849, St. Luke's from 1850, and Mount Sinai from 1852. The present City Hospital of New Orleans was endowed in 1780; the Massachusetts General Hospital dates from 1821; and the Johns Hopkins Hospital of Baltimore was chartered in 1867 and opened in 1889. The first Canadian hospital was the Hotel Dieu of Quebec, founded in 1637.

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**HOSPITALIZATION INSURANCE.** See INSURANCE, *Casualty*.

**HOSPITALLERS, KNIGHTS HOSPITALLERS, KNIGHTS OF THE HOLY SEPULCHRE, or KNIGHTS OF ST. JOHN OF JERUSALEM,** afterward Knights of Cyprus, then of Rhodes, and lastly of Malta, had their origin in Palestine in the middle of the 11th century, their aim being to succor and protect Christian pilgrims visiting the Holy Sepulcher. Certain Italian merchants of Amalfi had previously erected in Jerusalem a Benedictine chapel and two hospices. Upon this foundation there soon arose a great organization, pre-eminently military in its character, although continuing to be professedly religious. The European occupation of Jerusalem (1099) after the First Crusade greatly modified and enlarged the scheme of the community of St. John's. At this time it received papal recognition, exemption from tithes and from all episcopal jurisdiction, together with many privileges from the kings of Jerusalem—in short, became a complete autonomy. See CRUSADES.

**Reorganization of the Order.** After the death of the first rector, Gerard, in 1118, his successor, Raymond Dupuy, a French noble, proceeded to cast the organization in that military mold which distinctively characterized it, constituting three grades—the knights, who formed a fighting force for the defense of the Latin kingdom of Jerusalem against the Saracens; the chaplains, whose duty it was to continue the religious traditions of the order; and the serving brethren, who performed menial work. The chief power was vested in the rector, or grand master, who ruled as president of the council; and this body appointed certain knights of the fraternity, under the name of preceptors, to administer the affairs of the hospital in those European countries in which it had possessions and convents, or commanderies. At one time the order possessed no less than 19,000 manors in different parts of Europe.

Like their contemporaries and congeners the Templars, the Hospitallers possessed many strong castles in Syria, and on the suppression of the Templars in 1312 their lands were mostly transferred by the pope to the Hospitallers. See TEMPLARS.

**Defenders of the Mediterranean.** In 1291, owing to the reconquest of the Holy Land by the Saracens, the headquarters of the Hospitallers were moved to Limasol in Cyprus. In 1310, under the Grand Master Villaret, they captured from Greek and Moslem pirates the island of RHODES, where they settled, becoming known as "Knights of Rhodes." They remained masters of Rhodes until 1523, when, after a long and stubborn siege, they were obliged to capitulate to the Turks under the Sultan Suleiman, and retired to Candia (Crete). In 1530 their property in England was confiscated by Henry VIII; and in the same year Charles V assigned them MALTA, with Tripoli and Gozo. Tripoli was surrendered in 1551 to the corsair Dragut, who in 1565 laid siege to Malta, which the Hospitallers had fortified. Dragut was beaten off with the loss of 25,000 men.

**Decline of the Order.** After the Reformation the order rapidly declined in political importance. In 1798, through the treachery of some French knights and the weakness of the last grand master, Ferdinand Hompesch, Malta was surrendered to the French. The lands still remaining to the order were confiscated in almost all the European states; but certain branches of the order continued to exist in Italy, France, Spain, England, and Germany. After 1801 the office of grand master was not filled, till in 1879 the pope appointed a grand master for the Italian and Bohemian "languages." The present order is a society for the care of the sick.

The Hospitallers wore red surcoats over their armor. The badge was a Maltese cross, white and



ROCK ISLAND LINES

### Bathhouse Row at Hot Springs National Park

edged with gold. The motto was "Pro fide" (For the Faith), with the later addition of "Pro utilitate hominum." (For the benefit of man.)

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**HOST**, the consecrated bread of the Eucharist. In the Roman Catholic Church the host is a thin circular wafer of pressed unleavened flour on which is stamped some emblematic device, as the Crucifixion, the Lamb, or the letters IHS. The celebrant, who uses at mass a larger host than that reserved for other communicants, first breaks it into two pieces, one of which he himself receives. The other piece he breaks over the chalice, and drops a portion into the wine—"the mingling of the body and blood of Jesus Christ."

The elevation of the host is the act by which the priest immediately after pronouncing the words of consecration raises the host with both hands above his head, while the server sounds his bell that the congregation may adore Christ present.

In the Oriental churches the Eucharist is celebrated in leavened bread; one of the grounds of separation from the West alleged by Michael Cerularius being the Western practice of using unleavened bread. In the Greek church the consecrated bread is dipped in the wine before it is administered to the communicants. Luther followed the Roman Catholic Church in using unleavened bread, but did not break the host. The use of wafer bread in the Episcopal church is not uncommon, but it is usually quite plain. See **EUCCHARIST**; **CORPUS CHRISTI**.

**HOSTILITY**. See **AGGRESSION**; **HATE**.

**HOT AIR HEATING**. See **HEATING AND VENTILATION**.

**HOT BULB ENGINE**. See **INTERNAL COMBUSTION ENGINE**.

**HOT SPRINGS**, city, Arkansas, county seat of Garland County, on the Missouri Pacific and the Rock Island railroads and U.S. highways 70 and 270; about 58 miles SW of Little Rock. Picturesquely located in the Ouachita Mountains at an elevation of from 600 to 1,400 feet, the city is spread out with pleasant informality on hills and in canyons. **HOT SPRINGS NATIONAL PARK** almost surrounds the city.

Incorporated in 1851, the city grew as a part of the Federal reservation until the area was separated from the town by an Act of Congress in 1876. In

## Hotel

1913 a disastrous fire swept the city, destroying many old buildings, which have been replaced since by modern structures. Luxurious hotels, cottages, and bathhouses have been built to accommodate tourists. Although the city's prosperity is dependent upon the spa, Hot Springs has manufactures of lumber, mattresses, awnings, brooms, food products, and bottled mineral water. A general military hospital has been located here since 1882; a new structure was completed in 1933. Pop. (1950) 29,307.

**HOT SPRINGS**, city, SW South Dakota, county seat of Fall River County, on the North Western and the Burlington railroads and U.S. highways 18 and 85, about 100 miles S of Deadwood. There are medicinal springs and the town is frequented as a health resort. It is located at a halfway point between Wind Cave National Park and the Angostura Dam reservoir. Hot Springs is a center for an agricultural region producing alfalfa seed, corn, and potatoes. The city was settled in 1879 and incorporated in 1890. Pop. (1950) 5,030.

**HOT SPRINGS CONFERENCE**. See **UNITED NATIONS**.

**HOT SPRINGS NATIONAL PARK**, famous health and pleasure resort with 47 hot springs, in SW central Arkansas. The springs have been owned by the government since 1832. The park contains 1,019 acres, including Hot Springs; North, West, and Sugar Loaf mountains; a part of Indian Mountain; and Whittington Park. The springs are believed to have been visited by De Soto in 1541 and were a favorite stopping place for the Indians. Early settlers made pilgrimages to the springs and the first bathhouses were built in 1830 at a time when the settlement was at the edge of the western frontier. For many years the area was known as Hot Springs Reservation. Additional land was added from time to time, and in 1921, Hot Springs became a national park.

**HOT WATER HEATING**. See **HEATING AND VENTILATING**.

**HOT WAVE**. See **HEAT WAVE**.

**HOTBED**, a heated boxlike structure that rests on the surface of the ground and has a removable top made of glass or various other transparent materials. It is valuable to gardeners, permitting the growth of early crops of such vegetables as radishes, carrots, beets, lettuce, melons, and tomatoes.

**HOTCHKISS, BENJAMIN BERKELEY**, 1826-85, American inventor, was born in Watertown, Conn., and after a common school education learned the machinist trade. He perfected the cannon projectile invented by his brother Andrew, and because of the accuracy of this weapon, succeeded in interesting the Japanese and American governments in its purchase. During the Civil War he supplied the Federal armies with improved percussion and time fuses and with a punch projectile to be used against ironclads. Later, he invented for the French army (1872) a more practical machine gun, making it a defensive instead of an offensive weapon, and a magazine rifle (1875), which was adopted by both the U.S. Army and Navy. Just before his death in Paris, he was engaged in producing an automatic machine gun which was both air cooled and gas operated.

**HOTEL**. It was not until the Tremont House was built in Boston in 1829 that the word "hotel" was given the meaning applied to it today. Having its origin in the Old French word *hostel*, the appellation hotel in that language meant a public building or town hall, the *hôtel de ville* of present-day France. In the late 17th century, however, or about the time of the settlement of the 13 colonies in America, hotel began to come into use in the Anglo-American world as a word meaning a public inn. Before then, a public house or guest house was known as an "inn." It is significant that the term hotel should emerge with the settlement of America, for it was in this country that the modern hotel achieved its greatest development. The term was slow in gaining currency. Even





**Flats are Prepared** for planting vegetable seeds. Mixture of sand and screened composted soil is used



**A Vegetable Seedling Flat** being prepared for planting is covered with glass to slow evaporation

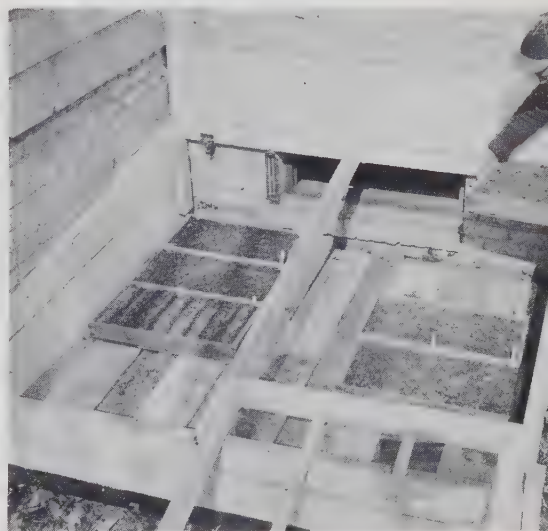
## HOTBEDS

**an aid to early growth of vegetables**

Hotbeds may be heated in several ways, as by hot air, circulating from a heated adjoining structure (as in the accompanying picture), or in pipes; hot water in pipes, electric heaters, and fermenting manure. Manure is the commonest source of heat. Thermostatically-controlled electric heating is the most modern method and has proved very satisfactory. Flexible, lead-sheathed resistance wires, manufactured especially for this purpose, are laid across the bed at intervals and covered with soil. A cold frame in sunlight will trap considerable amounts of heat. The direct solar radiation penetrates the glass easily but the heat radiated by the soil, being of longer wave lengths, does not readily pass through the glass. It is often necessary to open the glass top during the day to prevent the accumulation of too much heat

U.S.D.A. PHOTOS

**Vegetable Seedlings** are transferred from flats to pots in preparation for hardening in cold frame



**A Combination Hotbed and Cold Frame.** Heat from basement window maintains desired temperature

**Seedling Plants** are watered in cold frame where they are hardened off. Frame is opened on mild days





BETTMANN ARCHIVE

## Tremont House, regarded as the first true hotel

after the Revolution many public guest houses continued to be called inns. With the construction of the Tremont House early in the 19th century, the designation hotel acquired the meaning we apply to it today. A majestic edifice in its time, this Boston establishment is considered the first true hotel.

As a building type, the hotel of today carries on essentially the same functions as its prototype in the beginning of recorded history, the caravansary of the East. In the King James version of the Bible these caravansaries are identified as inns. An earlier and more primitive form of resting place for travelers than the caravansary was the khan, an unfurnished building that provided traders and their camel trains with both shelter and defense. The caravansary was the first type of public house operated by a staff of attendants. During the days of the Roman Empire, post stations were in existence on the many great highways of the empire, but these were reserved for messengers of state and for privileged persons. Later, in the period of the Middle Ages, many monasteries served as hotels, providing food and shelter for wayfarers. When traveling expanded during the Crusades, special brotherhoods were formed to welcome travelers, whether sick or well, and these brotherhoods set up hospices in the walled cities of Europe.

**Inns**, as understood in the later sense of the word, first appeared in Europe about the 15th century, or during the early Renaissance, when trade and travel greatly increased. These were establishments in which, for compensation, food and lodging were provided for the guest. As they were much in need at the time, these inns spread rapidly and soon were operating in England. They were usually constructed around a square courtyard which was entered by a covered passage, a form of design followed in the main by the old inns of Germany, France, and Italy. When the 13 colonies were founded in America by English emigrants, they brought with them the same designs for their inns as were used in the mother country. Incidentally, the word "tavern" has often been used interchangeably with "inn," but strictly speaking, the former refers to a place serving only food and drink. In the colonial South, early taverns were known as "licensed ordinaries."

**Improvements.** As improvements were added to dwelling houses, so these improvements were adopted almost at the same time by inns and hotels. In the field of illumination, for example, innkeepers made use of each new method of lighting as quickly as it appeared in the home. Like dwelling houses of the period, inns during colonial times were lighted by tallow candles. After the Revolution whale oil lamps were used. Then appeared the kerosene lamp previous to the Civil War, and this was followed by the introduction of illuminating gas. After 1880 electric lighting spread rapidly. The first use of electric lights in a hotel was made in the Hotel Everett which stood on Park Row in New York City.

The hotel era in America, and in fact throughout the world, began in earnest with the appearance of the Tremont House, which social historians now regard as the first true hotel. It was a three-and-a-half story building designed in the Greek Revival style, its facade made of white granite blocks. The architect

of this building was Isaiah Rogers, who afterward won renown as a leading hotel designer. It is said that the Tremont House cost \$300,000 to build. Among innovations first introduced at the Tremont was a lock on the door of each of its 170 rooms, a bowl and pitcher with free soap, gaslight in its public rooms, water closets and bathing rooms on the first floor and in the basement, French cuisine, and "rotunda men" (the world's first bellboys).

This Boston hostelry stood unrivaled until 1836. In that year the American fur trader, John Jacob Astor, entered the hotel field, and became a pace-maker in American hotel history. In 1836 the first Astor House was completed. As builder and owner of the establishment, John Jacob Astor made New York the hotel center of the world, an achievement which his descendants were to continue with their series of hostelrys, each one grander than the former. Among other improvements, the Astor House, which was six stories high, offered water closets and cold running water above the first floor—a marvel at the time. The first of the Astor hotels remained standing on its original site at Broadway and Vesey street for almost 80 years, an old landmark in a changing city.

**Types.** With the rise of such early hotels as the Tremont and the Astor, there appeared a variation of this type of building, called into being by social needs of the time. This was the resort hotel. One of the earliest of these was the Catskill Mountain House, a fashionable resort for New Yorkers of the 1820's and 1830's. Similar resort hotels soon appeared at such spas as Saratoga Springs in the North and White Sulphur Springs in the South. In the 1820's there came, also, the seaside resort, one of the first of which was established at Nahant, Mass. This was the prototype of such later fashionable beach resorts as Cape May, Long Branch, and Atlantic City, all on the New Jersey coast. In Florida, at a later period, hotels of this kind were often designed in the Spanish manner, such as the famous old Ponce de Leon Hotel in St. Augustine. It was from this type of hotel there evolved the residential hotel, where guests lived for long periods, some even making it their home. In time the residential hotel became almost as familiar as the commercial hotel in American cities, where they are sometimes known as apartment hotels.

What is regarded as the most famous hostelry of America, if not of the world, was the old Waldorf-Astoria, which stood on the west side of Fifth Avenue, between 33rd and 34th streets, in New York City. Designed in the German Renaissance style by Henry J. Hardenbergh, this building was a "twin" edifice of red brick and sandstone. The first section of this establishment was built in 1893 by John Jacob Astor's

## A modern luxury hotel in St. Petersburg, Fla.

ST. PETERSBURG N.S.





grandson, William Waldorf Astor (afterward Lord Astor of England). He named it the Waldorf Hotel. Four years later, his cousin, John Jacob Astor IV, built the second section adjoining the Waldorf Hotel, and the two units thereafter became known as the Waldorf-Astoria, both being operated by one of America's noted hotel managers, George C. Boldt. It was in this setting that Oscar Tschirky served and became celebrated as "Oscar of the Waldorf." In the years following, the two Astor cousins built a series of ever larger and grander hotels in various parts of New York City. At the present time, one of the main sights of Manhattan is the new, 46-story Waldorf-Astoria Hotel, which is said to have cost \$40,000,000 to build and furnish.

Another city that kept pace with hotel design and construction was Chicago. Here was developed that unique combined hotel, theater and office building widely known as the Auditorium. Built in 1889, the Auditorium was in part the work of one of America's foremost architects, LOUIS SULLIVAN. Associated with him in the design of this building was another well known Chicago architect of the period, Dankmar Adler. A pupil of Louis Sullivan's, FRANK LLOYD WRIGHT, afterward designed the Imperial Hotel at Tokyo (1916) introducing the articulated foundation, a method of construction that could withstand earthquake shocks. After the great Chicago fire of 1871, "fireproof" hotels came into being. One of the first of these was the Park Avenue Hotel in New York City. About this time fire escapes were added.

**Skyscrapers.** In Chicago the first skyscraper was built. A Chicago architect, William Le Baron Jenny, is generally credited with evolving the steel skeleton method of construction, a method which, together with the invention of the elevator and the pioneering work on foundations done by the elder John W. Root, of Chicago, made possible not only the skyscraper of today but also the skyscraper hotel. As a consequence of such innovations it became possible to construct such gigantic hostleries of the 20th century as the Stevens (Conrad Hilton Hotel) in Chicago and the Waldorf-Astoria in New York. JOHN DRURY

**HOTHOUSE.** See GREENHOUSE.

**HOTIEN.** See KHOTAN.

**HOTSPUR.** See PERCY, SIR HENRY.

**HOTTENTOT,** a native race of South Africa, believed to be of the same racial stock as the Bushmen from whom they have diverged through Hamitic admixture. There were four dialectical groups; Cape Hottentots, Eastern Hottentots, Kora, and Naman; but they are a disappearing people, through war, disease and miscegenation, so that it is difficult to know their numbers. In 1926 it was officially stated that in South-West Africa there were 15,376 Hottentots including mixed bloods. There are recognized communities of halfbreeds such as the Griqua, the Rehoboth "Basters" and the Komaggs "Basters" but few pure bloods remain. The best-known division of Hottentots are the Naman or Namaqua in South-West Africa. In appearance the Hottentots are well proportioned, slender, of medium height (average about 5 feet 3 inches), with yellow skin, prominent cheek bones, flat noses, and woolly hair. The Hottentots are semicivilized, having villages and primitive agriculture. See RACE, Races of Man.

**HOTTENTOT BREAD.** See ELEPHANT'S FOOT.

**HOUDINI, HARRY,** 1874-1926, American magician, was born in Appleton, Wis., of Jewish parentage (Weiss). He began his sensational career as a trapeze performer at the age of eight and also worked for a time in a locksmith's shop. His earliest trick was to free himself after being securely tied up with ropes; then from rope and handcuffs. Growing ever more difficult and amazing, his feats included breaking out of the stoutest chains, locks and prison cells with perfect ease. He hung head downward, strait-jacketed, handcuffed and ankle-ironed from high buildings, to wriggle free in the sight of neck-

craning crowds. He exhibited a long catalogue of remarkable stunts around the world, before kings and nobility, mystifying all alike. In his later years he exposed numerous tricksters claiming magic or supernatural powers, whose tricks he performed equally well and even better. He accumulated a vast library on stage and magic subjects, which he willed to public institutions. He published *Handcuff Secrets*; *Miracle Mangers*; *Spooks and Spiritualism*; *Rope Ties and Escapes*; *The Zanetti Mystery*.

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## HOUDON, JEAN

**ANTOINE,** 1741-

1828, French sculptor. In 1761 he won the Prix de Rome. He remained in Rome 10 years, and during that period executed his fine colossal statue "St. Bruno"; then returning to Paris, he was admitted to the Royal Academy (1777), and was elected a member of the Institute (1796). In 1785 he came to the United States, where he sculptured the statue "Washington" placed in the State House at Richmond, Va. His work was classically simple, and his mastery of materials was complete. Turgot, Rousseau, Voltaire, Diderot, Franklin, Lafayette, Mirabeau, Napoleon, and Mlle. Arnould are some of the other great personages whose features he has perpetuated.

In 1890 a statue of him was erected at Versailles.

**HOUFFALIZE,** town and popular summer resort, Belgium, Luxembourg Province, in the upper valley of the Ourthe. Surrounded by the Ardennes Highlands, which reach 2,000 feet, Houffalize is located at an altitude of 1,100 feet. There are a 13th-century Gothic church and the ruins of an old castle and of the ancient abbey of Val des Ecoliers. Houffalize occupied a key position as a communications center during World War II. Its roads and railways linked southern Belgium with France and with Germany, whose border was only 15 miles away across the northern tip of Luxembourg. As it lay in the middle of "The Bulge," the town changed hands four times in 1944-45, and was finally taken by the American First Army on Jan. 15, 1945. Pop. about 1,300.

**HOUGH, EMERSON,** 1857-1923, American author, was born in Newton, Iowa, and educated at the University of Iowa. *The Story of the Cowboy* (1897), his first successful book, was followed by a quantity of adventure fiction based on cowboy life and the history of the West. Among the most popular of his novels were *The Law of the Land* (1904); *54-40 or Fight!* (1909); *The Covered Wagon* (1922); *North of 36* (1923).

**HOUGHTON,** village, NW Upper Michigan, county seat of Houghton County, on Keweenaw Peninsula, Portage Lake, the Copper Range and the Duluth, South Shore, and Atlantic railroads, and



A. L. DEMENTI  
"Washington" by Houdon





Roman Catholic Church. It was later incorporated into the *BREVARY* in the Latin rite, though it is still used in its original form in the Armenian and Ruthenian rites. Some of the finest achievements of the medieval miniaturist are represented by books of hours prepared for noblemen, royalty, and ecclesiastical dignitaries. Designed to display the wealth of their owners, these books were elaborately bound, with decorative bosses of precious and semiprecious stones set into the covers. They were commonly lettered in black and red, and were embellished with illuminated initials and borders and with numerous detailed miniatures in liquid gold and color. Among the most beautiful books of hours which have survived are the "Tres Riches Heures" of the Duc de Berry (15th cen.), remarkable for brilliant landscapes which combine a striking realism with the medieval concept of the picturesque; the Hours of Étienne Chevalier (1461), illustrated by JEAN FOUQUET; and the Hours of Anne of Brittany (1508). See FRENCH ART; ILLUMINATED MANUSCRIPT; MINIATURE.

**HOURS, CANONICAL**, certain hours of the day set apart by church canon for prayer and devotion. These hours were eventually arranged as follows: Prime, 6 A.M.; Tierce, 9 A.M.; Sext, at noon; Nones, 2 or 3 P.M.; Vespers, about 4 P.M.; Compline, 7 P.M.; Matins and Lauds, at midnight or daybreak. In the Church of England the term refers to the time during which marriage may be legally solemnized, i.e., 8 A.M. to 3 P.M.

**HOURS OF LABOR**. See LABOR, HOURS OF.

**HOUSATONIC RIVER** rises in Massachusetts in the Berkshire Hills and flows generally southward through Massachusetts and Connecticut, entering Long Island Sound near Bridgeport. In its 123-mile course it falls 983 feet, affording water power to many manufacturing towns.

BIBLIOG.—C. P. Smith, *The Housatonic* (1946).

**HOUSE, EDWARD MANDELL**, 1858–1938, American statesman, was born in Houston, Tex., and studied at Cornell University. He became active in Democratic politics, and helped to secure Woodrow Wilson's nomination for president in 1912. He visited Berlin and London in 1914 as President Wilson's personal representative, in an attempt to avert the impending war. He headed the American mission to the Paris conference to co-ordinate Allied war activities (1917); represented the United States at the Supreme War Council (1917), and at the Allied Council which negotiated the Armistice (1918); was a member of the American Commission to Negotiate Peace (1918–19), of the commission which drafted the Covenant of the League of Nations, and of the Commission on Mandates (1919). He was joint editor with Charles Seymour of *What Really Happened at Paris* (1921).

BIBLIOG.—Charles Seymour, *The Intimate Papers of Colonel House* (4 vols. 1926–28).

**HOUSE**, a structure which serves the physical functions of the family. See also HOUSING.

#### PREHISTORIC AND PRIMITIVE HOUSING

Earliest known habitations of man are the caves of Europe and China. In these shelters primitive man took refuge from the elements and from predatory animals. He had fire, and around his hearths, well within the overhanging rocks, his family groups set up housekeeping. They had no pottery or similar utensils, so had to cook their meat over the glowing coals. Once the meal was over, the fire furnished warmth and protection while they slept. We may suppose that they had skins for beds but all traces of these and other perishable objects have vanished. In much later times primitive man in the southwestern part of the United States also used caves. The early Basket Makers of about the first to fifth centuries A.D. utilized the caves—first for storage and later for dwellings. Apparently their first artificial shelters were poles leaned against the back walls of

the caverns to serve as wind breaks. Later they dug pits in the floors and built light superstructures of saplings above them. The development of these pit houses into the multi-roomed Cliff Dwellings forms an interesting chapter in the archaeology of North America (see ARCHAEOLOGY, American). Some cave dwellers are still to be found in parts of British East Africa and Ceylon, while artificial caves and rooms are cut in the face of loess cliffs in north China.

Among the simplest dwellings of primitive man are the huts used by the Pygmies of the Philippines and other parts of southeastern Asia. Forked saplings driven into the ground hold smaller sticks which support the palm leaf roof. Some of the better houses may have raised platforms which serve as floors and beds but many lack these and all are without sides. This type of structure is easily made and is widespread where the climate permits. It is claimed that some of the Australian tribes, at the time of their discovery, lacked even these frail shelters, simply using wind breaks when necessary.

**North America**. Since America furnishes a wide variety of structures we turn there for a comparative series. Most readers are familiar with the snow house of the central Eskimo. This consists of blocks of compact snow cut with a slight bevel so that when they are laid up in spiral form the final top block locks all together. Such dwellings are heated by means of stone or earthen dishes in which seal oil is burned with a wick. Entrance is by means of a covered tunnel which helps to exclude the cold and also furnishes a place for the dogs to sleep. A more widespread type of Eskimo winter dwelling is formed by excavating a pit five or six feet deep, at the sides of which is placed a framework of whale bone or wood. A roofing of whale ribs is given a final covering of moss and earth. Like the snow house, it possesses the covered side entrance. Closely related to these is the widespread earth lodge, usually with a depressed floor, a framework of saplings covered with bark and finally earth or sod. The large lodges of the Mandan and Omaha were of this type; the ceremonial houses of the Maidu and other California tribes conformed to this pattern as does the *hogan* of the Navaho. Even the grass houses of the Wichita are but modifications.

Most of the North American structures can be paralleled in other parts of the world. The semisubterranean lodge is widespread in northern Asia; the skin tepee has its counterpart in northeastern Siberia among the Reindeer Chukchi (Chuchee); while the felt covered yurt of the nomadic herdsmen of Mongolia and central Asia is close to the wigwam in form. The long house is found in South America, in Melanesia and Malaysia. In the latter area it is usually raised high above the ground on piles and may be of enormous size. Among the interior tribes of Borneo a whole village may be under one roof.

Tree dwellings occur in Malaysia and elsewhere. They usually are built to give the inhabitants protection from animals or human enemies and are not relics of ancestral tree dwellers.

**Central and South America**. In Mexico and middle America, where agriculture was first practiced on this continent, the people had established permanent villages before the beginning of the Christian Era. The development of their impressive religious and ceremonial structures has been treated under such headings as Inca, Maya, Toltec, and Aztec, but the dwelling of the common man has received but little attention in the literature. Fortunately the archaeologist has been able to trace the story of these less impressive buildings both through excavation and by studying the representations found on painted vessels, in sculpture, and in the codices. For example, the relief sculpture on the walls of the nunnery at Uxmal show structures much like those used by the present-day Maya. These and other archaeological evidences indicate that there has been little if any change in 2,000 years. This house of the





Primitive men lived in tree dwellings high above the beasts of the forests, or in caves protected always by burning campfires

The palatial home of a citizen of ancient Rome, with its spacious gardens, poplar trees, green shrubs, and statuary

Ancient Egyptians built houses of semimud bricks with flat roofs adapted for outdoor living in desert environment





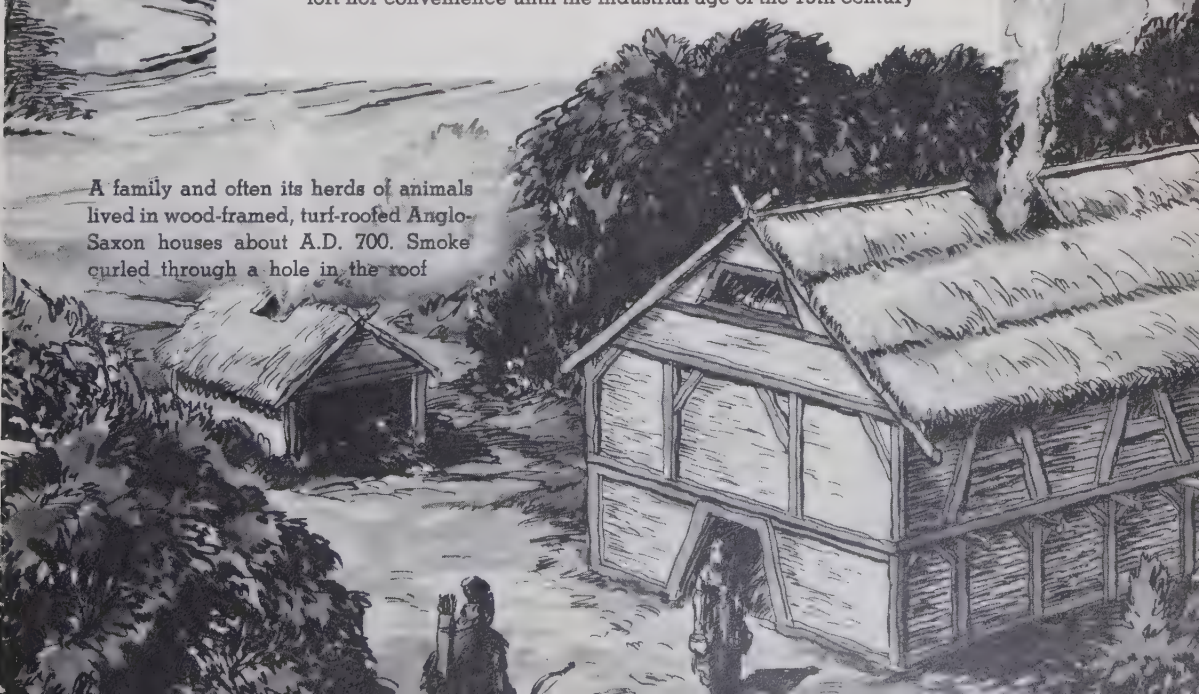
Early modern man built sapling huts on poles and platforms above the lakes of ancient Switzerland 12,000 years ago



## HOUSE

### Shelter for Family Living

Home is one of the warmest words in all languages, for within the walls of the home the family group developed, became the building block of nations and civilizations. The development of the house was slow. Over centuries the crude tree dwellings and caves of primitive men were slowly abandoned. Sapling huts were erected by ancient Swiss lake dwellers 12,000 years ago. Egyptians built houses of semibaked mud, with flat roofs adapted to desert climate and open-air living. Three-tiered dwellings on the island of Crete indicate that there were apartment-like dwellings in ancient times. Stripped of layers of lava 17 centuries old, Roman houses of ancient Pompeii were revealed as dwellings of great beauty. The rooms of these houses were built around open courtyards in which were splashing fountains, flower gardens, hedges of shrubbery. Over a period of 14,000 years houses attained beauty of form, but neither comfort nor convenience until the industrial age of the 19th century



A family and often its herds of animals lived in wood-framed, turf-roofed Anglo-Saxon houses about A.D. 700. Smoke curled through a hole in the roof



commoner is rectangular—about 22' x 12'—with end walls of saplings or stone. These go to a height of about seven feet and there support a framework of poles which rise to a ridge pole twelve or more feet higher. Finally comes a sharply pitched roof of thatch. The side walls are saplings daubed over with mud and plastered white. Such huts stand in sharp contrast to the great public buildings and temples, made of concrete with stone facings, which stood on the tops of elevated platforms or truncated pyramids. The Maya cultural center was the temple compound, not the city. There appeared the finest architecture and the most lavish art of prehistoric America.

Much the same story has been unearthed in Mexico. The tribesmen of 2,000 years ago, like the farmers of today, lived in huts with thatched roofs set on walls of wattle smeared with mud. First the Toltec and later the Aztecs developed cities in which houses were graded. On the outskirts were the frail huts of the farmers, then came more substantial buildings with adobe walls, next the pretentious homes of the well-to-do and, finally, palaces and temples. A chief's house had adobe walls set on a stone foundation, with wooden pillars supporting the roof of an anteroom. The acme was achieved in the palace of Montezuma. Here, rooms were placed at different elevations by means of terraces or ascending platforms. Social rooms, sleeping rooms, quarters for servants, as well as space for cooking and storage surrounded a central court. Windows were unknown, so outer rooms were open to a patio while the inner compartments were ventilated and lighted only by doors. The courtyards were cool and airy, filled with trees and rare plants which were reflected in the swimming pools. The still more elaborate temples stood atop truncated pyramids and dominated the city.

FAY-COOPER COLE

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#### HISTORIC TIMES

The character and physical nature of the house is influenced by climate, availability of materials, and social customs. The house in the cold country is most often built around the heating unit; in warm countries it centers around a cool, shaded court. Even today, most architects prefer to build houses out of locally available materials, because they feel that such materials blend best with their natural setting and are thus aesthetically superior to imported materials.

Technical advances also influence house building. From the times of the ancient Greeks and Romans to the end of the last century, there was little basic change in European house construction, simply because there was no basic improvement or change in building materials or methods of heating. Houses still had to be built around fireplaces. Methods of construction were limited by the tested abilities of wood, stone, and brick to support loads.

The great advances in technical knowledge in the past 60 years have radically altered the concepts of home builders. The introduction of such new building materials as steel and reinforced concrete have allowed the use of such new techniques as the cantilever. The introduction of really watertight roofing materials has made possible the use of flat or only slightly sloping roofs. Modern realization of the value of sunshine and fresh air has altered use of windows in modern houses.

**The Classical House.** Of the early Greek houses, most is known about those of the Minoan civilization on the island of Crete. Ruins of the ancient city of Knossos show stone stairways leading to upper stories. To defend the city it was necessary to house a large number of people in a limited area; thus houses of two and three stories were invented. In this way, 20th-century crowded cities with their multistory buildings had their prototype as early as 3000 B.C.

The Greek houses of the early Hellenic period were at first one room with a porch, much like a typical Greek temple. Later, an entrance hall was added, which led to an inner court around which rooms were arranged. These included the *oecus*, or living room; the *triclinium*, or dining room; the *thalamos*, or what is called today the master bedroom; and some secondary sleeping rooms. As far as can be deduced from the very incomplete ruins left today of the early Greek houses, they included no facilities for entertaining guests. However, Greek home owners may have acted as hosts on the open porch which occupied that side of the open court that had a southern exposure. This porch, or *prostas*, was no doubt the "outdoor living room" of the Greek houses. At the same time it shaded the southern rooms.

**The Homes of the Romans.** Much more is known of the houses of the Romans, thanks largely to the catastrophe which preserved intact the entire towns of Pompeii and Herculaneum. The early Roman houses consisted of one room only, called the *atrium*. This was the family's sleeping, cooking, eating, and living quarters. Later small rooms, called *cubicula*, were added around the atrium and the atrium roof was broken through in the middle to let in light. This opening was called the *impluvium* or *compluvium*. Rain water fell through this opening into a cistern or tank built in the middle of the floor. This was sometimes elaborately ornamented and surrounded by flowers and sculpture.

Besides the family rooms, the Roman houses had a *tablinum*, where tablets or family archives were kept. Houses of wealthy patricians often had two dining rooms, a cool one for summer use and a protected one for winter dining. Where there was enough space, there was often a third court to the rear, which was a garden. The most common building material was unfired brick, covered with stucco, with several fired brick layers on the top for protection. Rubble stone walls were also common. Floors were covered with mosaics or marble. In simple homes or less important rooms, unglazed ceramic tile was used.

In their northern colonies in Germany and Britain, the Romans heated their houses with *hypocausts*. These were systems of hot-air ducts under the mosaic floors, which were amazingly like today's ultramodern systems of radiant heating.

**Medieval Houses.** The European houses of the Middle Ages were a distinct reflection of the times. The instability and lawlessness of the period made protection the primary function of the house. A ditch, mound, or palisade surrounded all houses of consequence. Country castles, particularly in England, were surrounded by stone walls within which was a hall with subordinate buildings. The hall had a hearth in the middle. Late in the 14th century, the fireplace was moved to the wall and was capped with a hood and wooden screens were introduced to screen the entrance passage. At the other side of the passage were the pantry and buttery. The kitchen was in a separate building. Over the pantry and buttery was a gallery for minstrels or bedrooms for guests. A dais stood at the far end of the hall and behind it a door opened onto an audience chamber or to sleeping quarters for the women. In the 15th century, a winter parlor or dining room was added toward the courtyard. These early English country houses grew in a most haphazard fashion with little attention paid to comfort, convenience, or basic unity. The other rooms gradually added to the hall conformed to the main room neither in height, general direction, nor roof pitch. Thus, the early English house rambles in all directions and has a picturesque lack of unity. The Continental homes, however, grew more logically. Rooms were added fairly evenly on each side of the main room and under one roof so that the whole house preserved a certain air of monumentality.

In France, medieval homes have been well preserved, as in Orléans, Cluny, and Angers. They show





BETTMANN ARCHIVE

### French half-timbered houses of 15th century

shops on the ground floor with living quarters in the upper two or three stories. The large city house was called a hotel. One of the finest examples of a Gothic house of this type is the Hôtel Jacques Coeur in Bourges.

Space in European towns was so scarce within the defense walls, that in order to enlarge the interiors, upper floors were extended so that they overhung the ground floor. Sometimes they extended so far out that they had to be held up by posts. In this way the arcaded sidewalk originated. Of the few medieval town houses which have survived in England, one of the oldest (12th century) is the Jew's House in Lincoln. Others include the Rectory House at West Dean, Sussex, and the Parsonage House at Market Deeping, Lincolnshire. In Germany, half-timber houses and stone houses which lasted until World War II in such cities as Nuremberg, Hildesheim, and others, show high roofs, sometimes higher than the walls of the house. These attics were used for storage and for drying laundry, which custom persists up to the present time.

**Renaissance Houses.** The most basic changes in European house construction came in the time of the Renaissance. The invention of gunpowder made the city walls of little use and they were torn down. Cities expanded outward and architects could make greater use of space. In Italy, house builders returned to the concepts of their early Roman forebears, as is seen today in the Renaissance houses of Florence, for instance.

The classic idea of beauty was one of symmetry, and in the Renaissance houses, comfort was often sacrificed to this goal. In England, the great hall which had been the center of domestic and social life in the medieval houses shrank to the size of a mere entrance hall with living rooms adjoining it. These rooms were also constructed less to suit the convenience of the inhabitants than to fit the exterior splendor of the house.

The great London fire of 1666 and the rapid growth of the moneyed middle class caused a stepped-up demand for new houses in England. A house in the Georgian style is entirely symmetrical to the point that even the chimneys must be properly balanced. There is a central entrance with outside steps and a portico.

The Renaissance brought to European house building an increasing elegance in both interiors and exteriors. Rich carvings festooned roof edges, columns, and porticos of the town houses and country chateaus

of the wealthy. Interiors were given grandeur with high hallways, sweeping staircases, and rich panelings.

**Oriental Houses.** There are three main types of Oriental architecture as expressed in houses—the Islamic, extending from North Africa to India; the Chinese; and the Japanese. All three are a direct product of their regions. The crowded conditions of Islamic cities have required buildings of more than one story, and the traditional Moslem desire for privacy in the family has led to the placing of living quarters largely around inner courtyards and on upper floors. Floors are generally of tile, richly decorated in the homes of the wealthy.

The traditional Chinese peasant house is a rectangular thatched roof cottage of one or two rooms. Along one wall of the main room runs a waist-high shelf called a *k'ang*. Ducts under the rest of this shelf run from the stove built in at one end, and the family sleeps on the shelf in warm comfort. There are comparatively few isolated Chinese houses. The farmers have grouped together within village walls for protection and their houses usually abut each other. Wealthier Chinese have larger houses, but these are essentially the same as the smaller huts. They are merely collections of houses grouped together within a courtyard. Even the houses of the very rich follow much the same pattern.

Of all building styles, the Japanese is perhaps the most original. One of the oldest of styles, it is in many ways one of the most modern. Many modern architectural ideas of use of natural materials, of blending the house with the landscape, and of economy in the use of space stem directly from the Japanese. Even the idea of prefabrication was originated by the Japanese to a certain extent. The *tatami*, or bamboo mat, which forms the floors of Japanese rooms, is prefabricated and made in set sizes. The rest of the house is built to fit the size and number of tatami used, just as American architects design their houses to permit the use of prefabricated walls.

Native woods are used for the framework and walls of the houses. They are never painted, although interior paneling and the wood floors of the hallways are given a high polish to bring out the natural beauty of the wood. Many of the walls, both exterior and interior, are sliding panels of wood and cardboard. The interior panels may be thrown open if a large room is desired, or closed for privacy and warmth. In summertime, exterior panels are pushed back to lead out to a small balcony or to the garden.

Roofs of Japanese houses are of thatching or tile. They are usually of one story, although two-story houses are common in the cities. Each room has at one end a niche where flowers or statues are placed or where a picture scroll may be hung. On each side of the niche is a closet, opened by a sliding door. In these closets, the pallet beds of the Japanese are put

**Chinese Peasant House,** rectangular in shape, is a simple bamboo framework covered by thatched roof

AMERICAN MUSEUM OF NATURAL HISTORY



away during the day. During the night, when the beds are spread out, the few pieces of low furniture are upended against the wall. Some rooms have a built-in *hibachi*, or brazier, in which sticks of charcoal are burned for heat. The kitchen is usually a tiny cubicle built as a shedlike addition to the house. Some houses also have a bathroom in which the bath-loving Japanese place a high wooden tub.

**The American House.** The houses of the first English settlers in Massachusetts were generally two-room cabins built around a central hearth. One room served as a living room and kitchen, the other as a bedroom. Wood partitions between the rooms set off closets; sometimes a stairway to the attic formed one partition. Studs and beams alike were left exposed in natural wood against a plastered background on the outside walls. Ceilings were low (seven feet high usually) and windows were small.

Later, finer houses were built, but were almost entirely imitations of European houses of the time. In New England, the colonial house was Georgian in derivation, built in a compact plan for warmth. In the South, the plantation houses, of which Mt. Vernon is an excellent example, were also Georgian. Concessions were made to the warm climate with the use of high, columned porches and many air passageways, but the basic Georgian symmetry was kept. In the central colonies, the most popular houses were imitations of the former homes of the Swedish and Dutch settlers. In Florida, Louisiana, and the Southwest, the Spanish and French settlers brought their own forms from their homelands.

At about the time of the Revolution a new and very elegant style became popular. This was called the Federal style in America, but essentially it was the same neoclassic style then popular in Europe. Thomas Jefferson's Monticello is one of the outstanding examples of the Federal style.

As American cities grew and became crowded, a type of town house developed. Those still to be seen on Beacon Hill in Boston are typical. They are narrow and have three or four stories. Generally, the kitchen is in the basement, with a parlor and dining room on the first floor. Another, less formal sitting room is usually on the second floor. Similar houses were also built in New York and Philadelphia.

Perhaps the first truly American house was the farmhouse of the Middle West of the late 1800's. All living centered around the hearth or cookstove. The kitchen was large enough to accommodate all the hungry harvest hands in the summer. At night the family read in the kitchen by the light of oil lamps. Sleeping quarters were in cold rooms in a half-story above. Most of these homes had a stiff, chilly parlor in front, but this was used only on very formal occasions. The exteriors of these houses were as bleak and unornamented as their treeless settings of rolling fields and their lines as uncompromising with the elements as their inhabitants. This type of house was also built in the small towns that grew up on the prairies.

**The Victorian Houses** were ornamented on the outside with elaborate scrollwork, with domes and cupolas and towers placed without any relationship to the logic of the interiors. Inside, ceilings were too high for the amount of warmth the heating plants provided. Windows were narrow and heavily draped to prevent the sunlight's fading the furnishings. Colors were drab and dark, suiting the somber, pseudo-elegance of the furniture. The house was often more for show than for living. The interiors were designed for decoration rather than convenience. Only the plumbing, revived for the first time since the days of the Romans, was a real improvement.

**The Modern House.** The complete falsity of the architectural philosophy of the Victorian period called for an equally complete reform.

Twentieth-century architects began to study the functions performed in a house and to shape the

space to fit these functions. The French-Swiss architect Le Corbusier's slogan, "A house should be a machine for living," had an international influence on the character of the modern house. Instead of a symmetrical array of cubicles, parlor, library, and dining room were opened up to form one large living room. Air and light were let in. The exterior form followed the interior function.

Extreme functionalism, however, was soon challenged. The American architect, Frank Lloyd Wright, argued that the house must function as a well-run machine, but that it must also have individuality and integrity. His philosophy was called organic architecture. Wright taught that a house must grow out of its natural setting, as much in keeping with the soil, rocks, and climate of the terrain as is a twisted pine growing out of the stony side of a mountain cliff. There should be no break between exterior and interior materials and the whole house should have an over-all unity reflecting its location, its materials, and the character of its inhabitants.

These revolutionary new concepts in home building began to take hold and to be woven into the plans of almost all newly-built houses to a greater or lesser extent. One factor was the trend from urban to suburban living with the development of efficient interurban transportation. The tendency to open the house toward the outdoors was greatly aided by the newly-realized inherent possibilities of plate glass. This feature in house building naturally developed most rapidly in warm climates. But such devices as the solar house made outdoor living also possible in colder climates. The solar house has its southern wall made entirely of glass. During the winter this glass wall radiates the heat of the low sun through the glass. During the summer when the sun is high and hot, an extended eave over the windowed side shades the house.

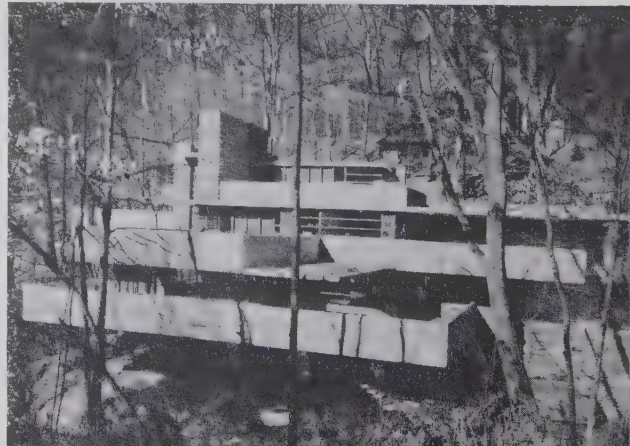
In Holland, Sweden, Switzerland, and other countries modern row houses were built in new Y-shape and star-shape groupings to provide better garden space and freer exposure to air and sun.

**The Prefabricated House.** One of the main concerns of the modern architect was to plan houses at minimum cost. The first attempt to standardize certain parts of a house to facilitate cheap, quick building was made in Germany. In the 1920's Erich Freiberger worked out a "Growing House" built of standardized elements. The home builder could order a minimum house with all utilities and gradually add more rooms as he needed them.

By mid-century many experiments had been made in applying scientific, industrial design to the construction of houses. In America a prefabricated house could be assembled on its site in several days. Its nucleus was a plumbing and heating utility core around which prefabricated units of floors, walls, and roof were co-ordinated. Various industrial firms

#### American house designed by Frank Lloyd Wright

ART INSTITUTE OF CHICAGO





manufactured these houses. Some were all metal ("Lustron" House, Aluminum House), others were all lumber and plywood. The most far-reaching step in prefabrication was the Dymaxion House, designed by Buckminster Fuller to be mass-produced similarly to an automobile. Thin floors and walls were hung by wires on a central column of duraluminum, which contained steps to the first floor and all installations for heating, lighting, and air-conditioning. The furniture was built in like beds are in a Pullman car. The house was round, and moved with every change of direction of the wind to give the least resistance. In Sweden an exposed steel frame was developed to carry preassembled wood panels. These could also be raised on steel stilts to the second floor level, allowing room below for a car port. Similarly in Turin, Italy, the "ABC," factory-built house was developed.

Although engineers tend toward complete mechanization in developing the mass-produced house, architects endeavor to find methods of prefabrication that would allow the house flexibility and individuality. See HOUSING. MARYA LILIEN

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#### HOUSE CRICKET. See CRICKET.

**HOUSE FINCH**, a small light-colored finch commonly called *linnet*, of northern Mexico and United States (Pacific Coast, Texas, Wyoming, Kansas), especially attractive on account of its musical, cheery, varied warble and beautiful plumage. Head and upper parts of the males have a suffused, rose red color; under parts are a mixture of red, soft gray, and brown. They are fruit eaters and also seed eaters (in winter weed eaters) and sometimes nest in cactus trees, locating according to water supplies.

#### HOUSE OF COMMONS. See PARLIAMENT.

**HOUSE OF DAVID**, a religious organization founded in 1903 at Benton Harbor, Mich. by Benjamin Purnell. Its members believe that they are the offspring of the 12 lost tribes of Israel, and that they will become the rulers and judges of God's kingdom which will be established on earth. Members of the cult give all their possessions to the organization and contribute all their services to the movement, the needs of the membership being supplied from the common fund. The sect carries on a number of different industries and activities to maintain itself, including an amusement park, farms, greenhouses, and baseball and basketball teams which tour the United States. The members are vegetarians, wear long hair, and never shave.

#### HOUSE OF LORDS. See PARLIAMENT.

**HOUSE OF REPRESENTATIVES.** See UNITED STATES, *Government*.

**HOUSE PLANTS.** Growing plants in the house is probably the only way in which many persons can enjoy gardening. Although some "indoor gardeners" are quite successful, and entirely satisfied with their results, others fail without knowing why. The successful house gardener knows the requirements of his plants. He understands that among other things, improper watering, very low humidity, and insufficient light are factors that contribute to poor plant growth. Since the indoor gardener has such an excellent opportunity to experiment, his interest need never wane. With a little patience and inquisitiveness he may even become an expert in growing rare kinds of plants.

**Light Required.** Plants must be exposed to the proper amount of light if they are to be grown successfully. Each kind of plant has its own light requirements. Some tolerate intense light, others moderate

amounts, and still others require very little (see table). If, for example, light-tolerant plants are placed in a shaded room, they usually do not thrive so well as plants that are given more light. Similarly, shade-tolerant plants do not thrive if exposed to bright light. It is therefore essential to know not only the light tolerance of the plants but the window exposures that provide the optimum light. In the Northern Hemisphere, light from east windows is never as intense as light from south or west windows. And large north windows, while ideal for some plants, may be totally inadequate for others. South windows in general are best for most flowering plants that require maximum light.

**Proper Humidity Is Required.** Some plants never attain their potential beauty because of low atmospheric humidity. This condition can usually be remedied without too much difficulty. Humidity may

#### SOME HOUSE PLANTS WITH RECOMMENDED WINDOW EXPOSURES

| SOUTH          | WEST               | NORTH AND EAST      |
|----------------|--------------------|---------------------|
| Geranium       | Spiderwort         | Boston and Holly    |
| Lantana        | Cornplant          | Ferns               |
| Heliotrope     | Fuchsia            | African Violet      |
| Cineraria      | Flowering Maple    | Pandanus            |
| Coleus         | Primrose           | Grape Ivy           |
| Cacti          | Asparagus plumosus | Norfolk Island Pine |
| Poinsettia     | Wax Plant          | Rex Begonia         |
| Some Begonias  | Jewel Weed         | Dieffenbachia       |
| Bulbous Plants | Crown of Thorns    | Fittonia            |
|                |                    | Palms               |

be increased by placing pans of water under the hot air register when a hot-air system of heating is used; by keeping vessels of water on radiators when the heating is by means of hot water or steam; by placing potted plants in jardinières; or by stuffing sphagnum moss around the pots. The moss should be kept moist but not saturated, because an excess of moisture is exceedingly harmful. When bowls of water are kept on radiators or hanging humidifiers are used, it is essential that the vessels contain water at all times. Good humidifiers may be made by submerging part of a cloth or wick in water with the remainder exposed to the air. The water rises by capillary action. Since the air in steam-heated rooms is said to be 5 per cent drier than desert air, it is advisable to select for such places sturdy plants like English ivy, sansevieria, aspidistra, rubber plants, cacti, and other succulents. These plants have thick or leathery leaves that minimize the amount of water lost through transpiration.

**Plants Must Be Properly Watered.** The successful indoor gardener knows when and how to water his plants. Some plants need water at least once a day, while others require it every other day or perhaps only once a week. The frequency with which plants are watered depends upon the type of plants cultivated and the physical conditions of the room, i.e., amount of light, humidity, heat. A plant requires water when the soil is dry to the touch, but never should the soil be permitted to become "bone dry." The appearance of the plant often indicates the need for water; for example, the plant may take on a grayish tinge or become flaccid. If water is so deficient that the foliage withers, the plant is usually beyond recovery. A simple way to determine whether a potted plant needs water is to tap the side of the pot with a knife. If water is needed the pot resounds with a sharp ring, otherwise a dull sound is produced.

Overwatering is just as harmful as underwatering. Since roots must have air as well as water, care must be taken to do a thorough job of watering without making the soil waterlogged. This can best be done by placing the pots in a basin of water until the soil is soaked and then allowing the pots to drain. Simply



**How a Fly Gets into the Air.** Starting at left, fly starts from a crouch with all six legs gripping the surface; its wings begin to flap; legs begin to straighten at all joints; wings are almost in full sweep

moistening the surface of the soil is not sufficient because all of it must be wetted. Plants potted in glazed, glass, and hard rubber vessels require much less water than those in clay pots; the reason for this is that glazed and similar containers are less porous and usually lack drainage holes. Some plants that require more water are gardenias, gloxinias, azaleas, heathers, poinsettias, cyclamens, and African violets; some that require less water are geraniums, sansevierias, jade plants, and cacti.

**Fresh Air Is Required.** Plants need air because it supplies the oxygen they must have to convert food into living tissue. Many persons believe, erroneously, that house plants consume so much oxygen from the air that their presence is detrimental to human health. But, in fact, when green plants are exposed to light, i.e., when they are manufacturing their food (photosynthesis), oxygen is liberated into the air. As plants respire (burn up food) they consume oxygen. Thus, when green plants are exposed to light both respiration and photosynthesis occur, and oxygen is consumed as well as liberated.

Fresh air is provided by proper ventilation, which is attained by admitting air into a room without causing sudden drafts. This can easily be done by opening the top and bottom of a window about three or four inches. Cold drafts especially must be avoided because they frequently check the growth of the plants. It is also important to provide fresh air when the plants are breaking out of dormancy, usually during the warm days of spring and autumn.

**Soils and Plant Foods.** House plants require soil that is carefully prepared. While some plants, like palms, do best in heavy soils, others, like ferns, poinsettias, and primroses, thrive best in soils of lighter texture. Most house plants require good loam that contains a substantial amount of humus, such as decayed cow manure, peat or leaf mold. Usually the texture of the soil can be altered without much difficulty before the plants are potted: for example, when the soil is light, humus is added to make it "heavier"; when the soil is heavy, sand is added to make it "lighter."

Because house plants can easily be killed with too much fertilizer, plant foods must be added to the soil cautiously. Moreover, a well prepared soil will usually retain its fertility for a long time. Only when growth is very slow, or the stems are weak or the leaves begin to turn yellow, or the plants bear abnormally small flowers or fruits is it necessary to add nutrients. Plant food may then be applied in either liquid or solid form.

A complete plant food contains all the elements that are essential for a plant's growth, among them nitrogen, phosphorus, and potash (see FERTILIZER, Commercial Manures). Commercial plant foods may contain all essential elements, or contain only those elements known to be deficient. Since complete commercial plant foods vary in composition, it is im-

portant to know the specific requirements of the plant before applying the material. Ordinarily a teaspoonful of powdered food is sufficient for a five-inch pot; large pots require more.

**Potting the Plants.** Seedlings are usually grown in shallow rectangular boxes called "flats." When the seedlings have developed their first two true leaves they are removed from the flats and transplanted into two-inch pots. There they are allowed to remain for as long as two to four weeks, depending upon their rate of growth. After the fourth week (if not sooner) the growing plants are replanted in larger pots. Transplantation is repeated at intervals, as determined by the rate of growth of the plants and condition of the soil. For the inexperienced gardener, the exact time to repot is often difficult to determine by observation alone. Instead, he must inspect the entire ball of earth after it is removed from the pot. The ball is easily released by inverting the potted plant on the palm of the left hand, straddling the stem between the second and third fingers, and then gently tapping the edge of the pot on a solid surface. If inspection shows that many roots touch the edge of the ball, the plant must be shifted to a pot one size larger. When a plant is repotted, pieces of broken pots, pebbles, or cinders should be placed at the bottom of the new pot, because these materials help to improve drainage.

**Insect Pests and Diseases.** Since many house plants are grown in rooms where the humidity is low, insect infestations are frequently encountered. Aphids (plant lice), mealy bugs, scale insects, and mites are the pests most commonly found on house plants, but fortunately such pests can usually be removed without much difficulty. Aphids can be controlled by spraying the plants, according to specific directions, with a solution of Black Leaf 40 (nicotine-sulfate). The control of mealy bugs is somewhat more difficult because a special oil spray is needed, one that will destroy the pests without damaging the plants. For mild infestations soapy water applied with a small brush is generally sufficient to dislodge the bugs. Scale insects can be removed by washing the plant first with soapy water and later with plain water, or by spraying the plants several times a week with a contact insecticide. Mites can often be eliminated by raising the humidity of the room and by syringing the plants frequently with plain water. If this treatment fails, a spray containing rotenone generally proves effective. Occasionally earthworms will infest the soil of a potted plant, but they are easily removed by dusting the soil surface with powdered lime, or by applying a solution of limewater.

Bacterial and fungus diseases, in contrast to insect infestations, generally do not constitute serious problems for the house gardener, especially when the plants are given proper attention. Control is usually effected by removing the diseased leaf or flower, or by spraying the plant with an appropriate fungicide.





GENERAL MOTORS PHOTOS

Only three legs remain in contact with surface; fly makes final thrust with one leg; in the two final frames, fly is air-borne. Entire action, photographed with a high speed camera, was completed in 1/20 second

If the plant has a deficiency disease, the necessary plant food must be added. FRANK K. BALTHIS

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**HOUSE SPARROW**, a European sparrow, known in the United States as the **English Sparrow**. Though it superficially resembles birds of the sparrow family, *Fringillidae*, this bird, *Passer domesticus*, belongs to the family of weaver birds, *Ploceidae*. It is found in Europe, Australasia, and America, is about six inches long, stocky in form, with a short, stout bill, pointed wings, and a short tail. The male is brown above, with stripes of black and chestnut, and grayish white beneath. The wings show a patch of bright chestnut and white bands; the top of the head is grayish, and the throat and chest patch black. The female is grayish brown or olive above, and brownish white or gray beneath. The usual note is an unmusical chirp. The house sparrow attaches itself most closely to man. At one time, it was very numerous in cities but is now usually found in rural areas where it feeds on grain and seeds. It builds a rough nest of straw or grass about houses or in trees, and lays from four to seven bluish-white eggs, speckled or blotched with brown and black. Several broods are raised in a season.

Introduced into the United States about 1850, the house sparrow has now spread over that country and Canada. Though it is occasionally useful as a destroyer of injurious insects, it is in general regarded as a serious pest. Active and pugnacious in its habits, it drives away many of the most useful and attractive of the native birds; it is extremely destructive to gardens, orchards, and farm crops and is noisy and dirty. It causes damage in towns, clogging rain-spouts and gutters with its nesting material. Practical methods of decreasing its numbers include destroying its nests, shooting, trapping, and poisoning.

**HOUSEBREAKING**, a term in criminal law for the act of breaking into a house, either forcibly or by fraudulent means, for the purpose of committing a felony. The breaking and entering constitute the crime, whether the felonious intent is executed or not. Different jurisdictions vary as to what type of structure is classified as a house; state statutes differing in their definition of the common law crime. House-breaking by night is technically called **BURGLARY**.

**HOUSEFLY**. The most familiar and widely distributed insect of the order *Diptera* is the housefly, *Musca domestica*. It is common throughout all the inhabited regions of the world, always occurring in association with man. The adult fly is gray and about one-fourth inch long. The abdomen is striped

and has brownish-yellow or red markings near the base. The eyes are red. The body and legs are covered with bristles. Each foot has two claws and two bristly pads upon which a sticky substance is secreted. This arrangement makes it possible for the fly to cling to rough surfaces, to walk on ceilings, and to stick to highly polished surfaces. The mouth parts form a proboscis especially adapted for sucking up liquids. Since there are no piercing organs, the housefly cannot bite. It has, however, a close relative, the stable fly, *Stomoxys calcitrans*, which is a vicious biter and resembles the housefly so closely in color and size that it is frequently mistaken for the housefly.

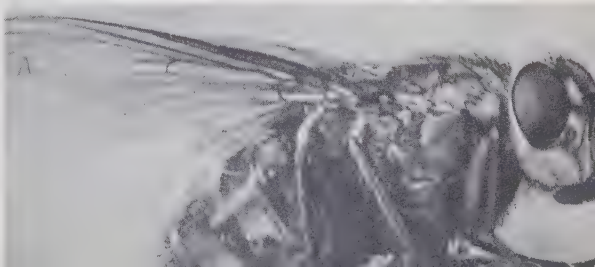
The housefly breeds in fermenting organic matter, especially garbage and manure. It deposits its eggs in such material within four to eight days after mating. The eggs are ovoid in shape, white, and glistening, and approximately one millimeter in length. About 100 to 150 are deposited at once, and a single individual may lay from 2 to 21 batches in a lifetime. The egg hatches within 24 hours, and there emerges a slender white larva, actively motile and voracious, without legs or distinct head, and provided with small hooklets at the mouth. It develops rapidly, completing its growth in from three to seven days and entering the pupal stage. After a period of three to six days or more the adult fly emerges from the brown, barrel-shaped pupa and repeats the life cycle. The entire life cycle may be completed in 6 to 20 days.

Flies have been found to carry on their bodies or in the alimentary canal the causative organisms of many diseases, especially those which are transmitted in human excreta. The housefly may be an important factor in carrying typhoid fever as well as other bacterial infections of the stomach and intestines, and possibly other diseases.

**Control of Houseflies**. Perhaps the most important aspect in the control of the housefly is the elimination of breeding places. Since houseflies frequently breed in garbage, it should be kept in cans with tight-fitting lids, and disposed of regularly by an authorized agency, or buried in the ground. Adequate sewage disposal systems are very important in the control of flies and fly-spread diseases. Lack of such systems still constitutes a concrete danger in

### Housefly, greatly magnified

LYNWOOD M. CHACE



## Household Economics

some backward communities of this country, but more especially in less advanced countries such as India and China. Outdoor privies can be protected from flies by daily applications of borax. Manure which cannot be disposed of may be sprinkled thinly over the ground or packed in covered containers.

Other methods of fly control consist of screening, and use of flytraps, flypaper, fly sprays, and electrically charged fly-killing devices. These latter are used especially around dairy barns. Fly sprays are of two types, space sprays and residual sprays. Space sprays are especially useful indoors. They commonly contain pyrethrum and DDT. Residual sprays employ stronger solutions of DDT, or newer insecticides such as methoxychlor, chlordane, and lindane. When properly applied to surfaces, they will kill flies which alight upon the surface at any time in an entire season. However, flies are becoming resistant to DDT, and are harder to kill with DDT substitutes. See **FLY**; **INSECTICIDES**. R. E. M.

**HOUSEHOLD ECONOMICS.** See **HOME ECONOMICS**.

**HOUSELEEK**, a genus of plants, a subdivision of the family *Crassulaceae*. They are succulent plants, the leaves being commonly revolute. Their flowers are usually stellate, sepals and petals numbering six or more. The common houseleek, *S. tectorum*, growing wild in the Alps, has become naturalized on European



J. HORACE MCFARLAND CO.

**Houseleek**

roofs and walls. It sends up leafy, flowering stems of six to twelve inches in height, bearing branches of pale red, starlike flowers, equally curious and beautiful. The leaves cut or bruised afford relief to burns, bee stings, ulcers, and inflamed sores. *S. soboliferum*, with yellowish green flowers, is frequently planted on walls in Germany. The fishermen of Madeira rub the fresh leaves of *S. glutinosum* on their nets to render them more durable.

**HOUSELEEK**, or **HEN AND CHICKENS**, the common name of several plants of the genus *Sempervivum* of the family *Crassulaceae*. The plants are perennial herbs with thick, succulent leaves in basal rosettes, often with secondary rosettes on offset branches. The flowers are radial, commonly yellow or purple, and occur in terminal cymes. They usually have six or more petals, one-carpeled pistils equaling the petals in number, stamens double the petal number, and sepals equal in number to the petals. The fruit is a follicle with several to many seeds. Houseleeks are commonly planted in rock gardens and in borders.

H. J. FULLER

**HOUSEMAID'S KNEE.** See **BURSITIS**.



COOK COUNTY HOUSING AUTHORITY

*Providing adequate housing, always a problem, has been aggravated by increasing population and shifts to urban centers*

**HOUSING**, a term used in three different senses: first, it may mean any type of human shelter; second, it may refer to the various types of activity which provide human shelter; third, it may be used technically to mean the component of city planning which deals with urban conditions relating to human shelter.

The objective of housing as a field of planning is to provide, for all kinds of people, shelter which is healthful, safe and sanitary; which is designed to give ample privacy and comfort; and which is so located as to meet the educational, cultural, recreational, and employment needs of the inhabitants.

The "housing problem" is actually a complex series of problems involved in the provision of adequate shelter under varying physical, social and economic conditions. Initial problems include those of land planning, design, use of materials, construction, financing, ownership and renting, and maintenance. Once shelter has been created, there are the problems of conservation and rehabilitation, as well as the clearance of badly-planned, damaged, and worn-out structures. See **HOUSE**.

Modern shelter is usually provided through one or another or a combination of several of the following types of endeavor:

*Custom Building*, in which the future owner contracts for erection of a home designed to meet his own tastes or needs.

*Investment*, in which investors commit funds to building for the purpose of providing a fairly stable, long-term return on the investment.

*Speculative*, in which the builder hopes for a profit from resale by passing the product on at an increased price. Often the builder seeks to secure his profit only from the land, offering the house at approximately cost price as an inducement.

*Eleemosynary and Philanthropic*, in which housing is provided by charitable institutions as a social service.

*Co-operative*, in which a group of persons pool resources, usually to provide housing for themselves at a cost which is lowered by elimination of profit.

*Industrial*, in which business firms or industrial corporations provide housing for their workers, usually as a means of stabilizing their labor market.

*Public*, in which government builds or operates housing, or aids directly others who build or operate housing.

## HISTORIC BACKGROUND

Little reference is made in history up to the 19th century to serious efforts to improve the housing conditions of the masses of people in the great population centers of the world. In this respect, the history of housing parallels the development of rights



of the individual, and thus it differs from that of other phases of city planning which flourished under despotic governments as under democratic ones.

**Ancient and Medieval.** The Greeks, Babylonians, and Romans were noted for the splendor and beauty of their public buildings and spacious homes of the ruling class, but were notoriously lax in planning for good housing. Medieval dwellings were generally small, airless, and badly overcrowded. The fortifications of medieval cities limited the area into which the population might crowd and resulted in the typical narrow streets with dwellings jammed close together, and the out-jutting second story, in an effort to increase floor space.

**In Europe.** The beginnings of the modern British housing movement did not come until 1814 when Lord Shaftesbury espoused the cause of better living conditions for the working classes. In Paris, primarily for military and esthetic reasons, Baron Georges Eugène Haussmann directed the cutting of wide boulevards through central congested areas, and although this eliminated much bad housing, the occupants were not rehoused but moved into other areas where they intensified the congestion there. When the Industrial Revolution brought a great influx into Europe's cities, the various governments were later forced to evolve vigorous housing programs. Although considerable progress was made in the early part of the 20th century, most European nations still suffered from housing shortages at the outbreak of World War I. That war devastated many areas of Western Europe and further aggravated the shortage of adequate housing. World War II wreaked further and much greater damage on many of these same areas, in addition to the destruction in Great Britain, most of Germany, and Russia, and new housing programs were pushed forward in the postwar period.

**In the United States.** The beginnings of a housing problem appeared in the early years of the 19th century when the young nation's cities on the eastern seaboard were already becoming overcrowded. With the advent of the Industrial Revolution, great numbers of immigrants poured into the United States and gravitated to the most congested urban centers. Cities were ill-equipped to absorb this influx and the further growth accruing from changes in the national economy. Without building codes or zoning, little or no control existed over the construction of housing and large sections of many cities were covered with shoddy dwellings and tenements.

By the end of World War I the nation's housing shortage had reached major proportions, a million units without regard to standards being needed to house Americans. In the 1920's, a boom in construction produced a large amount of housing and subdivision of residential land. While only 247,000 units had been produced in 1920, production reached 937,000 units in 1925. But the home building business was still relatively small and unorganized and was to be dealt severe blows by the economic collapse which brought on the depression of the 1930's. During this depression, great numbers of families were forced to double up and vacancies were widespread, while in 1933 the production of new dwelling units fell to a low of 93,000. With recovery, however, families who had been doubled up out of economic necessity began to absorb the vacant housing and by 1940 it was again evident that the building rate which was retarded by the depression had failed to keep pace with the increase in population. Thus even before World War II, many communities had experienced housing shortages which prevented even the normal shifting of families which had grown or decreased in size. With the enormous increase in industrial production during World War II, great shifts of population took place and the country faced a housing crisis which was only partially alleviated through government programing and control of materials and the construction of public war housing.

The problem of housing shortage again reached critical proportions in the postwar period as millions of veterans returned to find their homes occupied by war workers, and many more married upon return and were unable to find quarters for their new families. By 1947 the effective vacancy rate in nonfarm units had fallen to 0.8 per cent, as compared with the 3 per cent which is considered the minimum desirable rate, and many cities reported the local effective rate as "virtually zero." In the immediate postwar period, the National Housing Agency estimated that more than 12,000,000 new nonfarm dwellings would be needed during the 10-year period following World War II to meet the shortage, to accommodate new families to be created, and to replace only half of the existing backlog of substandard housing. In 1945 it was reported that 1,200,000 families were doubled up with other families, and in 1946 the ambitious Veterans Emergency Housing Program was instituted, calling for expanded production of building materials, price controls, preference for veterans in the sale or renting of new units, channelization of materials to low-priced housing, recruitment of labor, and other measures. A goal of 2,700,000 new homes was set for the end of 1947, but in December of 1946 it was apparent that the goal would not be reached and the program was replaced by a milder system of regulation. By mid-1947 the program was virtually abandoned, and except for relocated and reused temporary housing, only about 1,500,000 dwelling units were produced during 1946 and 1947.

In 1949 a long-sought goal was reached when more than a million new units were started, and in 1950 a record was established with a figure of 1,396,000. This rate continued during the following years; in 1954 about 1,175,000 new permanent dwellings were started. Never in history had the building of new homes continued at such a sustained tempo. About 95 per cent of the construction was for private ownership and about 5 per cent for public ownership.

The 1950 census of housing showed about 46,000,000 dwellings in cities and on farms, an increase of 23 per cent over 1940. The numerical increase over 1940 was about 8,550,000 units, counting occupied trailers, makeshift homes, conversions of nonresidential structures to homes, and the subdividing of larger units, as well as new construction. This growth was the greatest numerical increase in units between census years on record. Of the total dwellings, 39,390,000 were nonfarm, and of these all but about 10,000,000 were "urban," that is, located in places of more than 2,500 population or on the fringe of cities of more than 50,000 population. Of the occupied nonfarm homes, 2,500,000 were classed by the census as "dilapidated." Over 4,000,000 occupied urban units did not have hot and cold running water inside the structures. At least one in every four occupied rural nonfarm units did not have piped running water either inside or outside the structure. In the 1950 census a percentage improvement was noted in the number of nonfarm dwellings having private indoor flush toilets and private baths, the availability of these facilities being a common index of housing quality. The proportion of occupied nonfarm units with such toilets increased from 73 per cent in 1940 to 80 per cent in 1950, while the proportion of such units equipped with a private bath or shower increased from 68 to 77 per cent.

In nonfarm housing the vacancy rate had increased by 1950 to 1.7 per cent which while still only half the desirable minimum was more than double the rate reported in 1947. The 1950 census also showed overcrowding to be less percentagewise but about the same numerically as in 1940, the approximately 2,000,000 dwellings with more than 1.5 persons per room being 7.1 per cent of the nonfarm supply in 1940 and 5.5 per cent in 1950.

The decade between 1940 and 1950 saw significant development in the business of home building. For years the job of producing housing had rested chiefly with the small builder putting up a few houses each year, and thus home building had not, despite its vital place in the nation's economy, reached the status of an industry in the same sense as most other important production. But by 1950 the fabrication of homes was increasingly becoming mechanized and it was common for a single builder to undertake construction of hundreds of homes in one continuous operation. A number of builders in the postwar period had undertaken single projects of thousands of units.

#### TYPES OF HOUSING UNITS

The majority of housing unit types throughout the world fall into about four major categories. Climatic conditions, local customs, and available building materials may cause variation. Also, some localities have developed preferences for certain types of housing and, as a result, these are in greater usage than others. Economic conditions and social customs generally dictate what type of house is used by the most people. See *House*.

**Single Family House.** Generally speaking, the home reflects the world's social structure by placing emphasis on the family and the rearing of children. Therefore, the single family house has been the most widely used in the past, because it affords the greatest amount of privacy and sense of security to the family. In frontier and rural America, isolation and distance required single family houses, and American farm homes nearly always have been one-family units.

The modern single family dwelling usually has two stories and a basement on a 40 × 125 foot lot with a one-car garage. The first floor generally consists of a living room, dining room, and kitchen, and the second floor of three bedrooms of varying size and a bathroom. The basement contains a laundry, heating plant, and storage space. The construction generally consists of wood floors, wood framing, wood partition, plastered walls and ceilings, with exterior walls of brick or wood siding or shingles. Electric wiring and lighting and water, storm and sanitary sewers are generally available. In recent years, the so-called "ranch-house" has gained considerable popularity and has displaced the bungalow type of house in many localities. It has all its rooms on one floor, generally in an L-shaped floor plan, as compared with the square-floor plan of the average two-story house. It contains the same number of rooms, but requires a slightly larger lot—generally a 50-foot frontage. In addition, a great many homes consist of four or five rooms with or without a basement on one floor. When the basement is omitted, a so-called utility room is generally added. This room supplies the space for the heating plant, laundry, and utilities. The "ranch-house" also frequently uses utility rooms.

Where localities have zoning regulations restricting various areas to certain types of housing, the single family residence has enjoyed the greatest amount of protection from encroachment by other types of structures in any given neighborhood. In most zoning regulations, the single family residence is located in the most restrictive zone district. Most single family homes are owner-occupied and represent the largest single investment of most families.

**Duplex Homes.** In most zoning regulations, the duplex house enjoys the second highest requirements, since its appearance gives the impression of a single family home. It is usually planned as two houses side by side separated by a common party wall. This type of building is frequently permitted in certain areas of single family zoned districts, or is zoned as a distinct and separate district.

The duplex house is generally two stories in height with basement. Each house follows the plan of the average two-story single family home.

Usually, both units are owner-occupied and are popular because some original savings can be made through lower land cost and the party-wall construction.

**The Row House.** This type of dwelling is simply a series of individual homes placed side by side in rows of two or more, separated only by party walls. They are generally placed on narrow lots of from 15 to 20 feet with party walls on the lot lines. Daylight is available from the front or rear and by light wells with skylights overhead, located generally adjacent to interior bathrooms.

Floor plans of row houses usually include a separate entrance, both front and rear, with living room, dining room and kitchen on the first floor, two or three bedrooms and bath on the second floor and a heating plant, laundry and storage in the basement. They are nearly always constructed with brick exterior walls and wood frame floors and partitions.

The chief criticism of this type of house has been its dreary repetition of row upon row of the same house, in block after block of drab city streets. Today, however, in new developments with curved streets with the grouping of row houses in small units of two to four buildings and the limitation of the entire number in a neighborhood, some of the worst features have been discarded.

Row houses generally are owner-occupied and are fairly economical to operate, because of the small space occupied and minimum exposure, thus affecting the heating cost considerably.

**Multifamily Buildings.** Such dwellings are found in many sizes, shapes, and types of construction. The most common are as follows:

*The Two-flat Building*, generally consists of two apartments, one placed directly over the other, each containing living room, dining room, kitchen, three bedrooms, and a bath. Front and rear stairs and rear porch, and sometimes a sun parlor at the front, generally characterize this building. Open wooden or metal stairs forming a "fire escape" in the rear are typical. Construction varies by localities and includes frame, frame with stucco, and masonry.

*Multifamily Apartment Buildings (Walk-up Type)*. Many fall into the "flat building" type and the three-flats are the same as the two-flats with an added story. Often, a so-called "English basement," constructed about one foot below grade, is included. Many walk-ups have six to eight apartments and some have as many as twelve served by one front and one rear stairway. In older neighborhoods, multifamily buildings often have been divided into smaller apartments, resulting in overcrowding and blight. Building codes restrict such conversions, but lax enforcement of codes has permitted the growth of slums in many cities.

The so-called "corridor type" apartment building merely consists of a central vestibule on the ground floor with a corridor on each floor running the full

Parkmerced, San Francisco, houses 3,483 families  
METROPOLITAN LIFE INSURANCE CO.





length of the building. A stairway generally is located at the front and rear of each building. A variation of the "corridor type" is found in tropical countries where an open balcony takes the place of the corridor.

**Elevator Type.** Along with the development of elevators for multistory office buildings, came a corresponding freedom for constructing tall apartment buildings. Elevator type apartment buildings generally have the same floor plans as apartment buildings of the corridor types. Generally speaking, however, they are of a better type of construction, known as fireproof, and because of greater costs, usually require greater economies. This type usually has smaller apartments—of the "efficiency" or studio type—consisting of a combination living-bedroom, dinette, kitchenette, bath, and one, two or three bedrooms. Fine luxury type apartments also are to be found in elevator apartment buildings, often located conveniently to the central business districts of large cities.

**Modern Trends in Housing Units.** For new architectural developments, see HOUSE.

The orderly and efficient placement of buildings on the land in proper relation to their environment expresses what is meant by modern-day site-planning. The finest homes or apartment buildings become undesirable when crowded together. The lack of a land-use policy in our major cities up until the early 1920's greatly affected the acceleration of blight in slum areas. Obsolescence and deterioration played their parts, but overcrowding of the land played a major role. Zoning regulations are now in force in nearly all the cities of the United States and most major cities of the world today. This does not undo the harm that has been done, and only slum clearance coupled with intelligent planning, rehabilitation, and redevelopment will right the wrong. Subdivision regulations are a new device, also now in force in most cities, and control the subdividing and platting of all undeveloped land. It is here that great strides have been made recently through the power of local planning bodies to pass on and guide the planning of all new subdivisions by preparing standards for street patterns, utilities, and general layout of the site in relationship with the adjoining neighborhood or community. This often includes provision for recreation areas, school facilities, and shopping facilities.

**Large-scale Developments.** Where one owner or group of owners work together in the development of new subdivisions or large-scale projects in established neighborhoods, tremendous advantages in planning are gained. More green space, play space, light, and area for all concerned usually are the results in such ventures.

The modern-day, large-scale housing development nearly always has an interior street pattern designed to discourage through traffic, thereby reducing traffic hazards. The better planned developments have areas for recreation and shopping. If of sufficient size to



PAUL'S PHOTOS

### Large-scale housing development in Radburn, N.J.

warrant, space is set aside for school purposes. Streets are usually curved; lot sizes are ample; and streets, walks and utilities are installed.

Large-scale apartment developments are often laid out on what is called a "super-block." This may be anywhere from two to four ordinary city blocks in length by usually one to two in width. This is accomplished by the municipality vacating the old streets and permitting a new system of interior circulation, but frequently retaining the old underground utilities. The architect and planner are thus free to lay out buildings to the best advantage, with lower land coverage than in the past. Play spaces, and large green areas are made possible as contrasted with the unsightly and drab rear yards and alleys of former apartment developments. Garage compounds strategically located along with service drives and drying areas well screened by good landscaping all go toward making good living in spite of high densities of population in crowded cities.

Prior to the end of World War II, few large-scale private developments were undertaken except by philanthropists and large insurance companies, but these included Parkchester and Stuyvesant Village in New York City, Marshall Field Garden Apartments and the Rosenwald Garden Apartments in Chicago, and Baldwin Hills Village in Los Angeles, all apartment projects. Some early large-scale projects that included the planning, not only of housing but of all neighborhood facilities as well, included the town of Radburn, N.J., the Country Club District of Kansas City, Mo., and Euclid Village, Ohio, all privately developed.

After World War II, however, the advent of the "merchant builder" with new mass-fabrication techniques brought about extensive large-scale development in and around nearly every major city in the United States. Among the most notable developments of this kind was Park Forest, Ill., a completely new town 30 miles south of Chicago, planned for a community of 5,000 homes with a shopping center and an industrial belt and extensive community facilities. Also notable were the new communities of Levittown, N.Y., and Levittown and Fairless Village, in Bucks County, Pa., close to the new U.S. Steel Company Fairless Works. These communities were built by a single builder famous for efficient production and cost-savings by skillfully applying site-fabrication and prefabrication techniques. Significantly, a large share of such new construction has taken place in suburban areas outside the corporate limits of large cities.

### PRIVATE HOUSING

The field of private housing comprises a variety of related enterprises. Foremost of these is, of course, the home building industry which is also a segment

### Government apartment house in New Zealand

GOVERNMENT OF NEW ZEALAND



of the larger general construction industry and which consists of the various building tradesmen, architects, contractors, subcontractors, and materials suppliers which are essential to any form of building. (See CONSTRUCTION INDUSTRY.) In addition, there are included in the private housing field other enterprises which, while not actually engaged in construction work, are nonetheless involved, often essentially, in the provision of shelter. These include real estate operators, subdividers, appraisers, financiers and property managers. The activities of all the various participants in the field are extremely important to the achievement of ample, adequate housing for all kinds of people. Rising costs of materials and labor, poor organization, inefficient methods, collusive and unfair trade practices, and devious sales promotions have helped to raise the price of housing. Because the cost of decent shelter is above the means of many American families, thousands of people are relegated to substandard or slum dwellings which are the best they can afford.

**Real estate** is defined as land and its appurtenances, such as trees, structures, and utilities, and as such is both the raw material and the finished product of the building industry. The dealing in real estate is one of the largest of businesses, and investments in real estate represented more than half of the national wealth in 1930.

Before land is utilized for residential building purposes—except to provide only one or several dwellings—it is subdivided, a large parcel being broken down into smaller parcels. Land subdivision is itself a major section of the real estate business wherein raw land known as acreage is acquired by a subdivider and divided, the resulting parcels being sold to individuals. In some instances the subdivider improves the land by installing streets, walks, sewers, and water mains. In fewer instances, the subdivider is also the builder, who sells or rents to the individual the lot, house, and improvements as one piece of real estate in one transaction. In each of these types of subdivision activity abuses have occurred which have contributed to the stagnation of buildable areas and to bad housing conditions. Land which is subdivided but vacant and unimproved by utilities has no increased value because of the mere subdivision yet is sold at a "future use" value. If this future value, which is dependent upon favorable community growth, fails to materialize or if it were overestimated or misrepresented in sales promotion, the land often is abandoned or becomes hopelessly encumbered by delinquent taxes. Even when improved by utilities, lots may lie unused and become encumbered in a similar manner. In either case, not only is the buyer's investment lost and the municipality denied revenues, but clearance of the encumbrances may be so difficult that the land becomes unavailable for building and lies stagnant. Lots thus encumbered by delinquent taxes obstruct the normal growth of the community, forcing builders to "skip over" this land.

In addition to the subdivider, another important participant in the real estate business is the "BROKER," who may or may not deal in real property to which he himself holds title. The broker is most often the agent for the owner, carrying out the owner's business of selling, buying, or renting on a commission basis. In many states, brokers are licensed and regulated by law as well as being expected to follow the code of ethics laid down by the national organization of real estate operators.

Others who are directly involved in real estate as a livelihood are appraisers, who are experts in values; financiers who supply credit money in the various transactions (although much of the financing of real estate comes from banks and other institutions who do not limit themselves to mortgage investment); and property managers, who specialize in the management of rental properties. Often, of course, many large real estate firms carry out several or all of these

functions and may themselves own real property.

**Financing.** Both transactions in existing residential property and the development of new homes require extensive capital, usually beyond the financial capacity of those purchasing or developing the property. In the United States this financing is largely carried out through the MORTGAGE system, which since the beginning of the 20th century has grown to be a major factor in the nation's economic life. As funds of financial institutions grew and required new outlets for INVESTMENT, the availability of this money for mortgaging aided greatly the development of urban centers (although this development was not always wisely planned), and changed the character of home ownership. Virtually all private housing activity is now conditioned by the mortgage system and its pace is governed by the availability of mortgage money.

Several types of banks are sources of real estate financing. For some years "mutual savings banks," the outgrowth of Benjamin Franklin's early thrift teachings, have financed real estate transactions. National banks are limited to loans on real estate security up to 60 per cent of their time deposits but have not usually participated in the mortgage field to the allowed extent. Commercial banks have in recent years begun to invest in real estate mortgages. Legal reserve life insurance companies have entered the field and now constitute one of the largest sources of mortgage money.

The "building and loan" or "SAVINGS AND LOAN" ASSOCIATION is, unlike most other financing agencies, basically a real estate lending organization having the mortgage as its mainstay. The first such association in America was founded in Philadelphia in 1831 under the name of the Oxford Provident Building Association and was the beginning of a plan based upon the financing of homes for members of the association. By 1893 there were in the United States 5,598 such associations with total assets of \$473,137,454 and in the period between 1920 and 1930, when building was at a peak, the associations enjoyed a heyday, 11,777 groups having assets of \$8,828,611,925. The depression of the 1930's brought disaster to many of the associations and led to government assistance through the Federal Home Loan Bank System. (See below.) During this period there were many mergers, reducing the total number of associations, but total assets increased to nearly \$30,000,000,000 by 1955. The associations catered to small investors, usually wage earners, who deposited funds in savings accounts. On the lending side, the associations specialized in individual home loans.

**Governmental Aids.** Direct government subsidies and loans for private housing have been in use in Europe for a number of years, but in the United States federal and state aid to private enterprise has emphasized insurance against loss and the strengthening of financial institutions. In England, the Addison Act of 1919 offered nonrepayable lump sums upward of \$800 per house to private enterprise for construction of the "Homes for Heroes" promised by Lloyd George. Lump sum grants were again provided by the Chamberlain Act of 1923 but in 1933 subsidies were discontinued except for slum clearance. In 1917, Denmark established a governmental Housing Loan Fund which by direct lending at low interest rates aided the individual in meeting the rising cost of building; by 1933 the government was an integral part of a highly developed mortgage system. In the period following World War I, Germany raised funds for state assistance to limited-dividend corporations through special taxing of home owners who had happily found their mortgages wiped out by inflation. In most European countries, "public utility housing societies" and co-operatives have long enjoyed direct government loans.

Aside from restrictive legislation aimed at private housing reform, several homestead measures by Western states, and encouragement of limited dividend





AMERICAN COMMUNITY BUILDERS, INC.

**The Park Forest, Ill., development, a completely new town, was built on vacant land 30 miles from**

**downtown Chicago. Mass-fabrication provided rental units, shown above, and owner occupied dwellings**

corporations in New York in 1926, governmental participation in private housing did not come about in the United States until the depression years of the 1930's. The Federal Home Loan Bank System was established in 1932, to bolster the depression-beaten mortgage institutions by lending money against mortgages, providing a credit reserve for savings and home-financing institutions. By 1933 real estate foreclosures had reached the rate of 1,000 a day and the HOME OWNERS LOAN CORPORATION was set up under the FHLB system and given \$4,750,000,000 to refinance the loans of distressed home owners, up to 80 per cent of the value of the property, at 5 per cent interest, and repayable over a period of 15 years. More than a million loans, amounting to \$3,093,459,271 were refinanced between 1933 and 1936, when this function of HOLC was concluded.

The HOLC act also authorized the organization of Federal Savings and Loan Associations under the FHLB. By 1954 there were 1,613 such associations, with combined assets of \$14,500,000,000. Total membership in the FHLB system in 1954 was 4,153, with estimated assets of \$26,700,000,000. Title IV of the National Housing Act of 1934 created the Federal Savings and Loan Insurance Corporation, which insures accounts of depositors in the member associations, as the Federal Deposit Insurance Corporation insures deposits in member banks. The maximum original insurance coverage of \$5,000 per account was increased to \$10,000 in July, 1950.

The FEDERAL HOUSING ADMINISTRATION (FHA) was the government's first entry into the private building, as well as financing, field. Created by the National Housing Act of 1934, the FHA was intended to encourage both private building and lending and the modernization of homes by guaranteeing repayment of FHA-approved loans through a system of insurance. In no instance does FHA lend money but simply guarantees that certain loans made by financial institutions will be repaid to the lender. In effect, responsibility for the integrity of approved home loans is transferred from the mortgagee to the government. Before establishment of the FHA, the private mortgage system was marked by high interest rates and short-term security, and many home owners were forced to borrow on second mortgages that, in 1931, charged as high as 25 per cent interest. Under FHA, however, the reduction of private risk enabled extension of the term of loans and a lowering of interest rates, eliminated much of the necessity of second mortgages, reduced the amounts necessary for down payment, and encouraged the making of small loans for repairs. Of very great importance is the exercise of control by the FHA over the planning of new housing, mortgage insurance being denied those who will not conform to FHA standards of site planning

and construction. Yet while these factors are advantageous to the housing consumer, the FHA has consistently maintained its original objective: to encourage the builder to build and the lender to lend.

During World War II, both the FHLB system and the FHA were placed under the National Housing Agency. In 1947 the Housing and Home Finance Agency was established to provide a single permanent agency responsible for the main housing programs of the federal government. This agency included the Federal National Mortgage Association (converted to a private facility in 1954), the Home Loan Bank Board, the Federal Housing Administration, the Public Housing Administration, and the National Housing Council. In 1949 Congress passed a national public housing slum-clearance bill providing for a six year program and for extensive housing research. The Housing Act of 1954 introduced the urban renewal program.

**Home Ownership.** The advantages of home ownership include social and economic benefits to both consumer and community, but these accrue only if the purchaser's income is ample and stable, the danger of foreclosure minimized, the property well-planned and located in a neighborhood not likely to deteriorate more rapidly than the structure itself, the local tax structure favorable, and the home susceptible to ready marketing in case of the owner's financial stress or necessity for movement to another community. Nonetheless, there has been a persistent trend toward home ownership in the United States until in 1950 more nonfarm homes were owned by their occupants than ever before, 19,500,000 nonfarm homes being owned and 17,100,000 being rented.

Between 1890 and 1930 the number of nonfarm units that were owned by their occupants increased from 37 to 46 per cent. The depression of the 1930's causing many foreclosures, forced the percentage down to 41 by 1940. During the 1940's, because of the shortage of available rental units and a high degree of prosperity, the percentage rose, reaching 53 by 1950, the highest ever recorded. And, for the first time, the number of home owners exceeded renters. There was also a substantial increase in the number of mortgaged homes. By 1950, there were over 7,700,000 mortgaged homes among nonfarm, owner-occupied dwellings containing one to four units. The number of mortgage-free homes in 1950 was over 9,500,000, or 56 per cent of all homes.

**Co-operative and mutual ownership** usually differ from individual ownership in that speculative profit is removed. Generally speaking, the member owns a share in the undertaking based on the value of his dwelling unit, which he occupies but does not own, the title to the property being held by the group to which he belongs.

Co-operative housing has been prevalent in some European nations, especially Scandinavia, for years. Co-operative housing first appeared in the United States in 1916, the best known being the projects built in 1930 and 1939 by the Amalgamated Clothing Workers (CIO) in New York. These were government-aided only by tax exemption on the improvements as provided by a New York housing law.

During World War II, the Federal Works Agency and Federal Public Housing Authority adapted the co-operative formula to several federally constructed war housing projects. A project would be leased by the government to a nonprofit mutual housing co-operative, which also received an option on the purchase of the project at a fair market price.

In recent years a new development in U.S. co-operative housing has been the increased co-operative ownership of large homes, one-time mansions of wealthy citizens, which had since been cut up into apartments. When the owners decided to place such homes on sale, the renters took advantage of the opportunity and formed a co-operative to buy the home, continuing to occupy their same units. Another development was a provision of the National Housing Act of 1949 which gave privileged mortgage provisions to veterans' co-operatives.

### HOUSING IN EUROPE

**Historical Development.** The appalling state of dwellings in Europe's cities brought about agitation by 1850 for recognition of the public's responsibility in housing. In England in 1851 the Shaftesbury Acts, which included the idea of municipal construction of housing for workers, were passed. The Cross Acts, passed later, emphasized the need for planning adequate relocation for slum dwellers as part of slum-clearing programs. In Germany the Garden City movement was set off by the writings of Ebenezer Howard. In 1890 England passed the "Principle Act," which carried no appropriations but set forth the principle that housing was the concern of local municipalities aided by the government. From 1880 on, the city of Stockholm, Sweden, pursued a policy of buying land outside the city for private and public housing, and about 1896 Oslo, Norway, began public housing. In 1912 France initiated Public Housing offices and that year Holland began a program which grew to a comprehensive utilization of public, co-operative, and investment housing.

After World War I, most European countries began substantial public housing programs, made necessary by the war's destruction. In 1916 Denmark, where all housing had previously been privately built, began public housing as a relief for unemployment. The Soviet Union, facing a herculean job of transition from medieval housing conditions, consolidated housing activity under Giprogor, the national planning agency, in a number of instances building entire cities in conjunction with its industrialization program. In most other countries, government subsidies were introduced on a large scale for

the first time; England's Addison Act of 1919, Chamberlain Act of 1923, and Wheatly Act of 1924 enlarged the scope of building by local councils and in some instances gave the scope of building by local councils and in other instances gave subsidies to private enterprise, as well as to the municipal agencies. Between World Wars I and II, England and Wales had constructed about a million units through local government authorities and a half million homes through subsidized limited dividend and other corporations. By 1935, France had developed 3,556 projects through loan and subsidy.

Following World War II, public housing programs were expanded in many countries, particularly in those where actual hostilities had worsened housing conditions. In Britain local authorities provided 80 per cent of the 290,000 homes built in the immediate postwar period, and both the Netherlands and Belgium made large sums available to their public programs. Hardest hit by war housing damage, the Soviet Union emphasized new construction especially for returning veterans. Sweden, although untouched by direct military destruction, expanded construction enterprise with 90 per cent of all new housing benefiting from government loans or subsidies. New Zealand and Australia are, with Britain, the leaders in supplying subsidized housing for low income groups.

### HOUSING IN THE UNITED STATES

**American Experiments.** Although the federal government had supplied housing in areas of industrial expansion during World War I, public housing as a major social force did not come about in the United States until prompted by the economic depression which began in 1929. As the estimated number of unemployed jumped from 1,864,000 in 1929 to 15,653,000 in 1933, the construction industry failed to make the comeback through which it was expected to lead the economy to recovery. Consequently, public housing was instituted primarily to stimulate the building industry and to provide employment, the social objectives of slum clearance and low-rent housing being subordinated to these purposes. The National Industrial Recovery Act of 1933 provided for construction under public regulation or control of low-cost housing and slum clearance projects. Under this act, the PUBLIC WORKS ADMINISTRATION (PWA) first instituted a program of aid to limited dividend corporations. Later, 52 directly subsidized projects in 37 different localities were constructed by PWA and local agencies. Altogether the PWA program provided more than 20,000 dwellings at rents averaging about \$5.00 per room. During this period both the Department of Agriculture and Department of the Interior participated in "homestead" housing activity, but the most famous of experimental public housing projects were Greenbelt, near Washington, D.C., Greenhills, near Cincinnati, Ohio, and Greendale, near Milwaukee, Wis. These were built by the government in the 1930's as part of an experiment in the development and ownership of planned suburban

City trucks were employed to move 50 families from San Juan, Puerto Rico, slums into new housing

UNITED PRESS



The first 50 families moved into San Juan's 80-acre, 2,640-apartment low-rent Llorens Torres project

UNITED PRESS





towns. After World War II Congress directed that these "Green Towns" be sold to private investors.

**Public Housing.** In 1937, a long-range federal public housing program was launched with the passage by Congress of the United States Housing Act, which created the United States Housing Authority as a permanent corporate body with an original authorization for subsidies up to \$28,000,000 and for \$500,000,000 (later increased to \$800,000,000) of loan funds to be borrowed on the general credit. The basic responsibility for initiation and effectuation of the program was vested in local public housing bodies, the USHA retaining the right by contract to approve local operations and to set standards. Where subsidy is required, the USHA is authorized to lend the local agency up to 90 per cent of the development cost of a project. Loans bear an interest charge equal to the going federal rate of interest plus  $\frac{1}{2}$  of 1 per cent and are repaid over a period of 60 years. Subsidies are designed to lower rents from the levels which would be required to pay for the entire cost of the homes down to levels which low-income families can afford to pay. In order for a community to obtain subsidies and loans under the U.S. Housing Act, the following requirements must be met: (a) the state must authorize a local agency to borrow money for housing; (b) the community must show that low-income families cannot be housed by private enterprise; (c) local financing must be obtained for at least 10 per cent of the development cost; (d) construction costs must be kept within specified limits and prevailing wages must be paid; (e) occupancy must be restricted to low-income citizen families; (f) one slum dwelling must be eliminated for each new dwelling created; and (g) a local subsidy (usually in the form of tax exemption) equal to 20 per cent of the federal subsidy must be made available.

Only the administration and part of the financing of housing built under the housing act are actually "public," all other phases being carried out by private enterprise. The local housing agency hires private architects, lets construction contracts to private contractors who use materials from private sources, and finances the project in whole or part through private lenders.

When the low-rent housing program was curtailed at the beginning of World War II, 105,627 units had been constructed by local communities with USHA assistance. Amendment of the housing act then enabled utilization of 53,000 additional homes originally intended for low-rent purposes as housing for vital war workers, 24,000 more units of planned low-rent housing were deferred until after the war, making a total of 194,000 homes constructed or planned under the USHA program.

In 1942, the USHA became the Federal Public Housing Authority (FPHA) and a constituent of the wartime National Housing Agency (NHA). In 1947 when the emergency organization was abolished, the FPHA became the Public Housing Administration and was placed under the Housing and Home Finance Agency, which supplanted the NHA.

**The Local Housing Authority** was one of the important outgrowths of the experimental stage of public housing in the United States. Although federal aid was considered necessary and desirable, the experiences of the PWA housing program demonstrated a need for decentralization and more local control of housing administration, and this led to widespread adoption of the housing authority as the agency charged with responsibility for local housing programs.

Housing authorities are public corporations created under state law and possessing many independent powers. Authorities usually are under the direction of a board of five unpaid commissioners, appointed by the presiding officer of the county or municipality for which the authority is created, with a salaried executive and staff to carry out the policies of the



NATL. ASSN. HOME BLDRS

#### Privately built development, Kansas City, Mo.

commissioners. Commissioners are usually appointed to staggered five-year terms, the term of one commissioner expiring each year, so that political interference may be kept to a minimum. Although enabling acts sometimes vary from state to state, authorities generally have the power to act as bodies both corporate and politic: to select independent counsel; to sue and be sued in their own names; to acquire land by ordinary purchase or through condemnation; to issue bonds and invest funds; to build and operate housing; to act as agents for the federal, state, or local governments; to accept loans or grants from other governmental bodies; to investigate housing conditions, using the right to subpoena, and to make recommendations to other governmental bodies. In addition, most enabling acts declare property of the local authorities to be tax exempt.

Although housing authorities were at first formed in order to facilitate local benefits from federal aid, many authorities have expanded their activities to include the broader purpose of acting as local agents or advisory bodies in all types of public participation in housing. In addition to building and operating federally aided projects, housing authorities now often participate in state-aided programs, assist community planning bodies, advise municipalities on zoning and building code legislation, operate public information services, and aid in development of co-operative housing. In 1950, there were 836 established housing authorities in the 43 states having enabling legislation and in Alaska, District of Columbia, Hawaii, Puerto Rico, and the Virgin Islands.

**Military Housing.** Military housing was designed to relieve shortages. The damage to production efforts wrought by housing shortages in industrial areas was first recognized in October of 1917 when the United States was engaged in the production of ships and war materials for European battlegrounds. Delay was caused by lack of precedent for public construction even in emergencies and it was not until May of 1918 that Congress authorized creation of housing facilities by the United States Housing Corporation and the War Shipping Board.

With the defense emergency of 1939, the United States faced another housing crisis with respect to its industrial expansion. Migration to key production centers caused a shortage of homes with which private enterprise was hard pressed to keep pace, and in 1940, the federal government was forced to take stringent action under the Lanham Act, which provided for public construction of housing for defense workers. Controls were placed on critical materials and housing construction was limited almost entirely to that specifically reserved for war workers. In 1,200 communities war housing programs were instituted, consisting of acceleration of private building, and public construction of permanent homes, temporary units, and "stop-gap" housing such as trailers and dormitories. Nearly 2,000,000 workers were accommodated through intensified use of existing housing and over a million new homes were built. Public financing provided over 840,000 units, at a cost of some \$2,300,000,000. In several

## SLUMS AND BLIGHT



NATL. ASSN. HOME BLDGS.

**Low cost housing project in Detroit**

cases, entire new towns were constructed. Vanport, Ore., a city of 40,000 persons all living in temporary housing, was built with public funds in less than a year to provide homes for workers in the shipyards of Portland and Vancouver, Wash.

**State Housing Programs in the United States.**

With several exceptions, early state housing legislation consisted of restrictive measures controlling types and standards of construction, 11 states having passed such acts prior to 1917. Massachusetts, however, established a temporary Homestead Commission in 1909 and in 1911 authorized commonwealth assistance for suburban homesteads for workmen. Several years later, Massachusetts legislation established planning boards for all cities over 10,000 population with direction that emphasis be placed upon housing, and in 1915 the state constitution was amended to permit public condemnation of land, subdivision, housing construction to relieve congestion without subsidy. California in 1913 established a Commission of Immigration and Housing which sought to improve housing and sanitation in labor camps, and in 1915 Oklahoma authorized state loans to individuals up to \$2,000 to promote home ownership. North and South Dakota later adopted legislation designed to promote home purchase under sponsorship of governmental agencies.

Between 1920 and 1930 little housing action was taken by states, although the New York State Board of Housing was established in 1926 to supervise limited dividend corporations. With the advent of large-scale Federal programs, many states adopted enabling legislation to permit co-operation between local and Federal housing agencies. New York alone, however, soon established a subsidized housing program of its own, similar to that of the USHA, and broadened its activities under a new Division of Housing. By 1947 the New York program included legislative authorization for \$300,000,000 in loans and \$9,000,000 in subsidies for public housing. New York remains the only state to have adopted a USHA-type program, but Illinois in 1945 and 1947 appropriated approximately \$30,000,000 for various broad housing purposes, including subsidized public projects for veterans and families displaced by slum clearance.

After World War II a few states undertook public housing programs designed specifically for returning war veterans.

**Row of Houses** in slum section of Cleveland before a low-cost housing project to eliminate such areas

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**Definitions and Background.** A residential slum is generally defined as an area in which most of the housing is so dilapidated, badly planned, overcrowded, poorly-erected, or subject to adverse environment as to be a menace to the health, safety, morality, or general welfare of the inhabitants. Housing is said to be "blighted" whenever any of the influences which created slums are present to such an extent that property values are rapidly declining and development is stagnant. Slums and blight were known even in the earliest times and have existed in virtually every stage of civilization. In Athens and Rome attempts were made to control slums through law and in medieval times the nature of the fortified cities tended to create slums rapidly because of the necessity for intense land use within the city walls. In modern times, the severe slum conditions existing on a large scale in urban and rural areas throughout the world have incurred considerable public indignation and in Europe, Australia, and the Americas the clearance of slums has been an integral part of most governmental housing programs.

**Origins.** The modern slum may originate in a number of different ways and may be one of several different types. Since virtually every large city, most small ones, and many rural nonfarm areas have slums in one form or another, popular beliefs give rise to the theories that slums are inevitable and are made by the low-income families which usually inhabit them. Actually, however, slums of every pattern could have been avoided through proper social, physical, and economic planning.

**Costs of Slums** are of two types, social and economic, and the two are usually interrelated. Although not easily measured, social costs consist chiefly of the damage to the community wrought by the juvenile delinquency and crime, malnutrition and lowered resistance to disease, high death rates, and lowering of morale and morals which are so clearly associated with slum environment. The unusual extent of these conditions in slum areas is known to be derived largely from the congestion and overcrowding, hazardous structural dilapidation, lack of ventilation and adequate sanitation, absence of play space and adult recreational facilities. These social factors may also be translated into economic costs wherever the community provides social services at public expense. In Cleveland in 1934 the cost per capita for public health work in one large slum area was found to be \$2.02 as compared with \$0.64 per capita in the rest of the city. In Philadelphia the city-wide per capita cost for crime was found to be \$5.36 and in a selected slum area to be \$14.56. Although slum clearance with rehousing of slum dwellers cannot be considered a cure-all for conditions which are also greatly influenced by the incomes of the families so affected, both British and American experience has shown a

**Apartment Buildings** built during slum clearance project at Cleveland replaced houses in other photo

ACME





decided rise in the standard of living of former slum dwellers and a lowering of social costs and costs for municipal services wherever bad housing conditions have been rectified. See JUVENILE DELINQUENCY; CRIMINOLOGY, Criminal Sociology.

Economic costs not directly connected with health and other social factors are also spectacularly higher in connection with slum and blighted areas than with neighborhoods of standard housing. Most municipal costs for fire fighting as well as for social service and policing are incurred in slum areas, yet the return to the municipality in taxes is always unfavorably disproportionate. Since standard housing on the periphery of such areas is usually engulfed by the encroaching slums, losses in real estate investments amount to great sums.

**Urban slums** often develop as part of a process in which neighborhoods which were once stable experience several stages of blight, each being successively more severe, before actual slums appear. Usually the oldest housing areas, those built around the business section in the center of the city, are invaded by expanding business or new commercial establishments with a consequent lowering of value of residential properties. As this occurs, high-income families move to newer areas and low-income families move into the declining neighborhoods, often "doubling-up" out of economic necessity and thus hastening the deterioration of the aged structures by such overcrowding. The lower rents may not permit adequate allowance for maintenance, or unscrupulous landlords may neglect the structures since the low-income families must remain where rents are low and cannot force the making of repairs through threat of moving. The process may also be speeded up by the appearance of heavy traffic between the "downtown" and outlying areas and the failure of the city to furnish adequate community services to the rundown area.

**Rural nonfarm slums** usually represent an attempt by low-income families to obtain shelter in the outlying areas in the hope that it will be of better quality than that to which their incomes would limit them if they lived in urban centers. The "garden-homesite" in unincorporated areas near the city is often offered to low-income groups who seek to own a plot of land large enough for a garden and possibly a few livestock but who can afford only low-priced land and a minimum for development and building. In this type of rural development much of the housing is erected by semiskilled owners and much is designed as temporary pending the betterment of financial circumstances of the owners. The temporary dwellings become permanent when no financial betterment comes about, thus leaving many families in quarters which are inadequate and cramped. Communities built up in this fashion are seldom served by sewer and water facilities, and once such development is begun the area rapidly becomes a slum.

**Industrial slums** exist in many cities and towns of the United States as the result of the shoddy construction and monotonous planning which was evident in much of the "company housing" built in periods of industrial expansion. In some instances entire towns were created by industrial concerns and were often characterized by the row upon row of identical, cheaply built bungalows without toilets, gas, water, or electricity and made still less attractive by the smoke, dirt, and odors emanating from the factories or mines in which the inhabitants worked.

**Transient slums** are usually associated with seasonal work such as harvesting, which attracts migratory workers who move from place to place and usually live temporarily in trailers, trucks, tents or shacks. Such slums may also result from the immigration of workers to areas which are experiencing oil booms or suddenly expanded industrial production. The severe housing shortages following World Wars I and II caused a sharp increase in the number of families forced to live in mobile or temporary make-

shift housing, much of it being concentrated in transient slums.

**Racial Segregation.** Slum and blighted areas inevitably become the home of immigrant workers, whether from foreign lands or from rural sections of the United States. Because the majority of newcomers to large urban centers, which are mainly in the North are Negroes from the rural South, they predominate the rapidly expanding slums. Other minority groups also exist in these blighted areas. They include eastern Europeans, Mexicans, Puerto Ricans, and Orientals. Other groups that had previously immigrated to the cities have gradually moved out to better surroundings. This "natural" process of segregation of minority groups and newcomers in the slums becomes forced segregation when devices which restrict these certain racial groups to certain sections of the city. The "restrictive covenant," a typical device outlawed by the Supreme Court in 1948, was a kind of compact entered into by property owners, subdividers, or real estate operators who bound themselves not to convey property in certain neighborhoods to specified groups; or the "deed restriction," inserted in the deed at the time land is subdivided.

The role of forced segregation in the development of slums is based upon the congestion and overcrowding which inevitably results when the supply of shelter is less than the demand. Such conditions, regardless of the racial groups involved, cause physical deterioration, a marked decline of neighborhood standards, and an inadequacy of community services—all of which will be recognized as factors of blight. Under such congestion, normal real estate marketing is disturbed, occupants may stage a mass exodus, landlords reduce maintenance allowances, and further development may be halted.

Until our slums are eradicated and strict housing codes and occupancy standards are enforced, minority groups migrating to our cities will be forced into slum areas, regardless of race or nationality. The complete eradication of slums would do much to help solve the problems of racial segregation.

#### SLUM CLEARANCE AND URBAN REDEVELOPMENT

**Definition.** Urban redevelopment generally means the reorganization of the land-use patterns in urban areas carried out over a period of years through the use of public powers. This includes the clearance of slums for the construction of new residential areas, commercial centers, and industrial groups, together with the development of new parks, playgrounds, thoroughfares, and other municipal capital improvements. The term has also been used to include residential or nonresidential reconstruction of sections of cities wherein the land has been assembled solely by private interest as contrasted with local public agencies.

**Background.** Many U.S. cities have planning bodies that are charged with preparing and keeping up-to-date a general plan for the city or entire metropolitan area. These plans nearly always include a comprehensive guide of land-use designed to safeguard the future of the city. The city's nearest blighted areas generally receive special attention by the planning body with recommendations to the local governing body as to what specific sections of the slums should be attacked, together with recommended requirements for what uses the land may be put to as governed by population densities, zoning laws, parks, schools, traffic, and public transportation. The choice of specific sites and the carrying out of the "project" is left to the city's operating departments, usually in co-operation with the municipal land agency, housing authority, redevelopment commission, or some other similar official body.

With respect to the clearance of slums, some clearance was accomplished under the federal public

housing programs. However, the rebuilding was confined to public-housing dwelling units along with attendant new schools and recreational space. The approach to urban redevelopment on a broader scale was carried out in New York in 1941 with the clearance of a large slum area on the lower east side of Manhattan Island. The city sold the land at cost to the Metropolitan Life Insurance Company, which undertook the construction of "Stuyvesant Town," consisting of several tall structures with recreation and shopping facilities comprising an entirely new neighborhood. The agreement between the city and the company, as permitted in state enabling legislation, provided that the general taxes on the land for the first 25 years would not exceed the amount of taxes received before the land was cleared. This same approach resulted in two other similar projects by the same company in other parts of New York City.

**New Approaches.** At the end of World War II many American communities actively engaged in preparations for urban redevelopment on the principle of municipal clearance of slums with rebuilding by private developers carried out concurrently with other clearance for public housing. The principle was broadened further to include rebuilding of nonresidential development by private enterprise. Chicago, Philadelphia, Pittsburgh, Baltimore, and Providence, through state enabling legislation, created urban redevelopment commissions. They were later followed by Los Angeles, San Francisco, St. Louis, and Indianapolis. Other cities broadened the powers of their local housing authorities to take advantage of federal grants. In 1947 Chicago embarked on a large-scale redevelopment program with the use of city and state funds amounting to nearly \$44,000,000, which included \$18,000,000 for the construction of permanent relocation housing for the low-income families to be displaced by the rebuilding. In 1948 the Chicago Land Clearance Commission began clearance of a 100-acre slum site for redevelopment by the New York Life Insurance Company of a complete new neighborhood, to house approximately 2,000 families, that will include school, park, recreation, church, and shopping facilities. In 1949 the Pittsburgh Redevelopment Commission began clearance of a large slum area in its "Golden Triangle" to be redeveloped by the Equitable Life Assurance Society. This would include several tall office buildings in a parklike atmosphere.

**Re-use Value.** Recognizing the problem of costs and land assembly, the various state legislatures of the cities already mentioned that took early steps to remedy conditions of blight, made provisions for financing in addition to providing for the power of eminent domain. Funds were made available either through outright state grants or permissive legislation that gave cities additional bonding powers for redevelopment purposes. At the same time, it was clearly evident that the resale price to private investors could not reflect the entire acquisition cost of inflated slum properties. At the same time, most states, with the exception of New York, either could not or did not desire to permit a general tax abatement. If private capital was to be attracted to invest in redevelopment, some new approach had to be made. The resale price must be based upon the new use to which the area was to be put. This notion of writing down the value of slum property to its new-use value was finally accepted as the approach in the aforementioned cities with early programs. This new land-use, of course, had to comply with the community plan, and prices varied as the uses and the plan varied. As an example, a row house development would cost one developer one price while a group of multistory apartment buildings development would cost another developer another price.

In this way, the city would have its worn-out areas rebuilt and would regain the cost in a few years through higher land valuations for taxation.

#### SLUM PREVENTION AND URBAN RENEWAL

The housing act of 1949 established a Division of Slum Clearance and Urban Redevelopment and set up a five-year slum clearance program. Funds in the amount of \$1,000,000,000 were set aside for loans and \$500,000,000 were earmarked for grants-in-aid.

Although urban redevelopment was conceived as an approach combining all of the programs and resources available to a community for combating slums and blight, the causes contributing to the growth of these conditions were not being arrested, and new slum areas appeared as rapidly as old ones were eradicated.

The Housing Act of 1954 was a major step forward. This law treated inclusively the problem of slum clearance and urban redevelopment, public housing and neighborhood rehabilitation and conservation. But it made the local community responsible for planning, organizing and carrying out urban renewal programs as a precondition for federal aid. The term urban renewal indicates action programs aimed at slum prevention as well as slum clearance, with major emphasis on the rehabilitation and conservation of neighborhoods. Earlier neighborhood conservation and rehabilitation plans included the unique "Baltimore Plan" which, through code enforcement, required owners to restore buildings to minimum standards. Other rehabilitation programs were "Operation Fix-up" in Philadelphia and "Morningside Heights" in New York. These programs offered partial solutions. The 1954 Housing Act, however, envisaged conservation and rehabilitation as part of a comprehensive program of urban renewal. With the passage of the act, plans for such programs were developed for the Hyde Park-Kenwood area in Chicago and for an area around Columbia University in New York, and plans were projected in Philadelphia, Detroit, Boston, Milwaukee, and other cities. All stressed local community action and citizen support. Additional support of conservation and rehabilitation was provided through Section 220 of the new law authorizing 90 per cent FHA loans for rehabilitation of existing housing, as well as for new construction, in renewal areas. The FHA may also provide, under Section 221, 95 per cent loans for housing for families displaced from renewal areas. The urban renewal legislation is probably one of the most important steps ever taken by the federal government toward the prevention and eradication of slums.

See BUILDING CODES; CITY PLANNING; CONSTRUCTION INDUSTRY; FOUNDATION; HOUSE.

IRA J. BACH and FREDERICK T. ASCHMAN

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**HOUSMAN, ALFRED EDWARD**, 1859–1936, English poet and scholar, was born in Bromsgrove, Worcestershire, and was educated at St. John's College, Oxford. During his undergraduate years Housman inexplicably broke with his family and spent the rest of his life as a scholarly recluse. He worked as a clerk in the Patent Office (1882–92); taught Latin at the University College, London (1892–1911); and in 1911 was appointed professor of Latin at Trinity College, Cambridge. A great classical scholar in the tradition of Bentley and Porson, he produced valuable critical editions of Juvenal, Lucan, and Manilius. He became far better known, however, as the author of *A Shropshire Lad* (1896), a collection of simple but finely wrought bucolic poems in which he spoke with stoic complacency of the transience of youth and beauty. Later verse, in the same vein, was collected in *Last Poems* (1922) and *More Poems* (1936). In *The Name and Nature of Poetry* (1933) he apologized for the scantiness of his poetic production, explaining that poetry, for him, was a consuming fever whose pangs he could bear only momentarily. He cautiously evaluated his own achievements in an after-dinner speech in which he described himself as standing halfway between Wordsworth drunk and Porson sober—a better scholar than Wordsworth, a better poet than Porson.

J. J. M.

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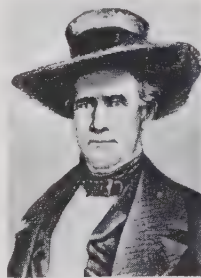
**HOUSMAN, LAURENCE**, 1875–, English author and artist, made his reputation as a book illustrator with drawings for Meredith's *Jump to Glory Jane* (1892), Jonas Lie's *Weird Tales* (1892), Christina Rossetti's *Goblin Market* (1893) and Shelley's *Sensitive Plant* (1898). Most noteworthy among his plays are *Bethlehem: A Nativity Play* (1902); *Prunella* (with Granville-Barker, 1907); *Lysistrata* (1911); *The Wheel* (1919); *Death of Orpheus* (1921), and *Victoria Regina* (1934). His volumes of verse include *Green Arras* (1896), *Spikenard* (1898), *Rue* (1899), and *Mendicant Rhymes* (1906). Among his other works are the novels *An Englishwoman's Love-Letters* (1900), *Trimblerrigg* (1924), *The Duke of Flamborough* (1928), *Back Words and Fore Words* (1946), a critical anthology of his own writing, and *Strange Ends and Discoveries* (1948).

**HOUSAS**. See **HAUSAS**.

**HOUSAY, BERNARDO ALBERTO**, 1887–, Argentine physiologist, was born in Buenos Aires and studied at the university in that city. In 1907 he became connected with the University of Buenos Aires as an assistant in physiology and rose to be professor of physiology in the faculty of veterinary medicine (1910) and in the faculty of medicine (1919). After 1944 he was director of the Institute of Biological and Experimental Medicine and carried out important research on snake, spider, and scorpion toxins and on the endocrine regulation of the secretions of the pancreas. He shared the 1947 Nobel prize in physiology and medicine, with Carl and Gerty Cori for his discovery of the significance in diabetes of one of the pituitary-produced hormones. With others, he wrote *Human Physiology* (1951).

**HOUSTON, DAVID FRANKLIN**, 1866–1940, American educator and cabinet officer, was born in Monroe, N.C. He was graduated from South Carolina College in 1887, and pursued graduate studies in government and science at Harvard (1891–94). He was adjunct professor and professor of political science at the University of Texas (1894–1902), president of the Texas Agricultural and Mechanical College (1902–5), president of the University of Texas (1905–8), and chancellor of Washington University, St. Louis (1908–13). He served as secretary of agriculture from 1913 to 1920; was a member of the Federal Reserve Bank Organization Committee (1913–14), member of the Council of National Defense (1916–20), secretary of the treasury, chairman of the Federal Reserve Board and of the Farm Loan Board (1920–21), and, after 1921, he was prominent in large business, financial, and educational institutions.

**HOUSTON, SAMUEL**, 1793–1863, American frontiersman, general, and statesman, was born of Scotch-Irish ancestry near Lexington, Va. His father had served in Morgan's Rifle Brigade during the Revolution, and was a brigadier inspector in the Virginia militia. The boy Sam, rarely called Samuel in his lifetime or by his biographers, was a poor



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Sam Houston

scholar but an eager reader of history and geography in his father's library. In 1807, after his father's death, the widow Houston with her six sons and three daughters moved to the frontier in Tennessee. Here Sam avoided farm chores, read the *Iliad*, and lived a carefree existence like many another frontier lad. When he was 15 he left home and lived for three years with a Cherokee Indian tribe whose chief adopted him and named him Colonneh, or "The Raven." At 18, well read and one of the best spellers in the region, he opened his own log-bench schoolhouse. Of his youth he himself wrote later in his "autobiography" that it "was wild and impetuous, but it was spotted by no crime."

In the War of 1812 Houston enlisted in the regular army to fight the British, but the 39th Infantry in which he was soon commissioned an ensign was ordered to support the Tennessee militia under Gen. Andrew Jackson in its forays against the Creek Indians, allies of the British. Houston was seriously wounded at the Battle of Horseshoe Bend (Tohopeka) and was made a lieutenant. After the war he was an Indian subagent and was admitted to the bar.

Popular, eloquent, and commanding, Houston was sent to Congress in 1823 and in 1825 by the Jackson Democrats who in 1827 elected him governor of Tennessee. He married during his governorship, but three months later his wife, Eliza Allen, left him for reasons neither ever disclosed. He abruptly resigned his office, joined the Cherokees in the West, married an Indian, and lived with the tribe for six years. He drew national attention for his championship of the Indians against dishonest government agents, and, armed with a commission from President Jackson, went to Texas in 1832 to make treaties with the Indians for the protection of American traders. A citizen of Texas, he attended the San Felipe convention which met in 1833 to ask the Mexican Congress to separate Texas from Coahuilla. After the War for Texan Independence began, Houston became commander in chief of the Texan army (1835).

On Apr. 20–21, 1836, at the Battle of San Jacinto, Houston with a small force overwhelmingly defeated the Mexican army and captured its leader, SANTA ANNA. Houston became president of the Texas Republic (1836–38) and was re-elected (1841–44). In 1840

he married Margaret Lea with whom from 1843 to 1860 he had six children.

When Texas was admitted to the Union in 1845, Houston, a Union Democrat, was elected one of its first two U.S. senators. As a senator he was for 14 years zealous in defense of the rights of the Indians, forceful in his opposition to the Kansas-Nebraska Bill and unwavering in his support of the Union and his condemnation of secession. He was elected governor of Texas in 1859, but was deposed in 1861 when he refused to swear allegiance to the Confederacy. He then retired from active political life, and, a widely venerated figure, died on his farm near Huntsville, Tex. A. W. Williams and E. C. Barker edited his *Writings, 1813-1863* (8 vols. 1938-43). For illustration and text, see TEXAS. W. P. S.

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**HOUSTON**, city, SE Texas, deep seaport and county seat of Harris County, is situated 50 miles inland, connected with the Gulf of Mexico by the Houston Ship Channel through Galveston Bay. The city is served by the Burlington-Rock Island, the Galveston, Houston, and Henderson, the Houston Belt and Terminal, the Missouri-Kansas-Texas, the Missouri Pacific, the Santa Fe, and the Southern Pacific railroads, U.S. highways 59, 75, 90, and 290, the Braniff, the Chicago and Southern, the Eastern, and the Essair air lines, and numerous steamship lines.

Houston, principal industrial city of the Southwest, was also, according to the 1950 census, the largest city in the entire South. It is situated in the heart of rich oil-producing regions, in the center of the fertile Texas Gulf Coast section, and near to the country's leading sulfur mines. The port of Houston, which has developed into the largest in the world for oil exporting, ranks second in the U.S. in deep sea tonnage and third, in total tonnage. Houston is one of the world's leading spot cotton markets and terminals. The Galveston customs district has its headquarters here.

The industries of Houston include petroleum processing, cotton compressing, and warehousing, cottonseed oil processing, ship building, meat packing, rice milling, and the manufacture of clothing, flour, oil field equipment, bagging, iron products, chemicals, paint, steel fabrications, paper pulp, cement, and lumber.

Houston is the seat of several schools of higher learning. Rice Institute, located on a 300-acre landscaped campus, is coeducational and nonsectarian. The University of Houston was developed from the Houston Junior College, a pioneer school of the state,

**Houston Turning Basin** of the 50-mile ship canal which links this Texas port to the Gulf of Mexico

HOUSTON C. OF C.



in 1934. Baylor Medical College and the Texas Dental College are also located in Houston.

The park system of the city covers 3,000 acres. Hermann Park has a large zoo and a museum of natural history, which has exhibits of all specimens of the state's natural life. About 20 miles from Houston is the San Jacinto Battlegrounds, a 500-acre state park with the 570-foot San Jacinto Monument in the base of which is a museum of history.

Houston is situated near the site of the Battle of San Jacinto where, in 1836, Gen. SAM HOUSTON and his men defeated Santa Anna's Mexican army. Shortly afterward in the same year, Augustus and John Allen, brothers from New York, migrated to the site of the present city and established a settlement. It was named for General Houston, hero of the Battle of San Jacinto and first president of the republic of Texas. Houston, incorporated in 1837, served as capital of the republic from 1837 to 1839 and again from 1842 to 1845. In 1905 the commission form of government was adopted. The inauguration of railroad service and the establishment of the ship channel in 1914 contributed in a large measure to Houston's growth and development. Defense industries accelerated the growth of Houston during World War II, and in 1948 several suburbs were incorporated into the city. Pop. (1950) 596,163. A. M. K.

**HOUSTON CANAL.** See CANALS.

**HOUSTON COLLEGE.** See COLLEGES.

**HOUSTON, FORT SAM**, one of the great military posts in the United States, located near San Antonio, Texas. The site has been the location of a military garrison since the establishment of a Spanish mission, San Antonio de Valero, in 1715. After Mexico gained her independence the fort was taken over as a Mexican post; in 1836 the fortifications were taken over by the new republic of Texas, and here occurred the heroic defense of the ALAMO. After the close of the Mexican War it became an American post; during the Civil War it was a Confederate post, but in 1865 was again taken over by the U.S. Army. In 1890 this fort, previously known as the post of San Antonio, was renamed in honor of SAM HOUSTON. It is now one of the largest permanent military establishments, being the headquarters of the Fourth Army Area.

**HOUSTON, UNIVERSITY OF.** See COLLEGES.

**HOVEDEN, or HOWDEN, ROGER OF**, c. 1117-1200, English chronicler, filled important offices at the court of Henry II and became professor of theology in Oxford. His *Chronicle*, in Latin, dates from the close of Bede's *Chronicle* in 732 to 1201.

**HOVENDEN, THOMAS**, 1840-95, American artist, was born in county Cork, Ireland. After studying art in England, he came to New York City in 1863 to enroll at the National Academy of Design. Afterward, while advancing his education in Paris, he frequently visited Brittany, using the peasants as subjects for paintings. In 1880 he returned to America and two years later was elected to the National Academy. Hovenden's most celebrated canvas was an historical painting, "The Last Moments of John Brown." He also excelled in pictures of farm life, such as "Breaking Home Ties."

**HOVENWEEP NATIONAL MONUMENT**, in SE Utah and SW Colorado, comprises four groups of remarkable prehistoric pueblo dwellings. Two groups, located in Keeley and Hackberry canyons of Colorado, contain fine masonry ruins which have withstood centuries of weathering. In Ruin and Cajon canyons, Utah, are interesting towers whose use has never been determined. On the rim of the cliff is Hovenweep House, a large semicircular structure, which probably housed 50 families. The monument, established in 1923, contains 299 acres.

**HOVEY, RICHARD**, 1864-1900, American poet, was born in Normal, Ill. He studied for the Episcopal ministry, but did not pursue that calling, devoting himself to literary, dramatic, and educational work. Among his works are *Lancelot and Guenevere*, a Poem in



*Dramas* (1891-8); *The Laurel, an Ode* (1889); *Songs from Vagabondia* (with Bliss Carman, 1893-6); *Along the Trail* (1898); *Taliesin, a Masque* (1899); *Last Songs from Vagabondia* (with Bliss Carman, 1901); *The Holy Graal* and *To the End of the Trail* (ed. Mrs. Hovey, 1907-8).

**HOWARD**, the family name of the British dukes of NORFOLK, and the earls of Suffolk, Carlisle, and Wiltshire.

**HOWARD, BRONSON**, 1842-1908, American dramatist, was born in Detroit, Mich., and was educated there and at Russell's Institute, New Haven, Conn. He worked for several years on New York newspapers but the success of his satirical farce *Saratoga* (1870) led him to abandon journalism. In succeeding plays he progressed from broad, satirical social criticism as in *Young Mrs. Winthrop* (1882) to more rigorous moralizing in *The Henrietta* (1887) and sophistication in *Aristocracy* (1892). He pioneered in the revival of a native American drama, but he lacked boldness and initiative, and the development of his art depended almost entirely on his sensitivity to audience reaction. His most successful plays were *The Henrietta*, which had an initial run of 68 weeks, and *Shenandoah* (1888), a Civil War drama which rivaled William Gillette's *Secret Service*.

**HOWARD, CATHERINE**, 1521-42, fifth queen of Henry VIII, was a granddaughter of the second Duke of Norfolk. Between July 21 and Aug. 8, 1540, she was privately married to the king. Shortly afterward evidence of alleged immoral conduct before her marriage was brought to light, and she was beheaded.

**HOWARD, HENRY**. See SURREY, HENRY HOWARD, EARL OF.

**HOWARD, JOHN**, 1726-90, English philanthropist. In 1756 he set sail for Lisbon to aid the survivors of the great earthquake there (1755); but the ship in which he sailed was captured by a French privateer, and he was taken to Brest and imprisoned. Returning to England on parole, he successfully negotiated an exchange for himself; and through his advocacy his fellow prisoners were soon afterward released. While acting as high sheriff for Bedfordshire he was impressed with the injustice under which many poor prisoners suffered; and this led him to visit the jails throughout Great Britain, and to devise regulations for the better treatment of prisoners. Chiefly as the result of his efforts, two acts were passed in 1774, one making provision for fixed salaries to be paid to the jailers, and the other enforcing greater cleanliness in prisons, with a view to the prevention of the dreaded jail fever. He also traveled extensively, visiting continental prisons and hospitals with a view to ascertaining the best methods of improving them. He published: *The State of Prisons in England and Wales* (1777) with *Appendix* (1780); *Account of the Principal Lazarettos in Europe* (1789).

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**HOWARD, LELAND OSSIAN**, 1857-1950, American entomologist, was born in Rockford, Ill., and studied at Cornell University. Joining the U.S. Department of Agriculture, he was assistant entomologist with the Entomology Service (1878-94), chief of the Bureau of Entomology (1894-1927), and principal entomologist in charge of this bureau (1927-31). He was particularly concerned with the relation of insects to disease. Among the practices which he introduced to curb the depredations of insects was importing some of the natural enemies of such pests as the gypsy moth and mealybug so as to establish a biological control. He also advocated keeping the cotton plant free of the boll weevil by rotating cotton with other crops, and was the first to eradicate the Hessian fly and similar crop devourers by changing the time when wheat and other grains were planted and cut. He wrote numerous books on entomology.

**HOWARD, LESLIE**, real name **Leslie Stainer**, 1893-1943, English actor, motion picture director, and producer, was born in London. After working as a bank clerk, he served in the English army, and on his discharge determined to become an actor. In 1917 he toured the English provinces in *Peg o' My Heart*, *Charley's Aunt*, and *Under Cover*, and in 1918 he made his London debut in *The Freaks*. After a series of London plays, he came to America (1920) to star in *Just Suppose*. He divided his time thereafter between the American and the English stage. Howard starred in *Outward Bound*, *Her Cardboard Lover*, *The Animal Kingdom* (which he also produced and staged with Gilbert Miller), and *The Petrified Forest* (also presented with Miller). He began his movie career in 1930 with *Outward Bound*, and then enhanced his reputation with such films as *Of Human Bondage*, *The Scarlet Pimpernel*, *Romeo and Juliet*, *Pygmalion* (which he also co-directed), *Gone With the Wind*, and *Intermezzo*. He is presumed to have died along with the other passengers in an overseas airliner en route between Lisbon and England during World War II; its last report (June 2, 1943) was that the enemy was attacking.

**HOWARD, OLIVER OTIS**, 1830-1909, American soldier, was born in Leeds, Me. He was graduated from West Point in 1854. He was in command of a brigade at the first Battle of Bull Run; at Fair Oaks, where he lost an arm; and at Antietam and Fredericksburg. At Chancellorsville he commanded the XI Corps, which was routed in Jackson's flank attack. At Gettysburg he was in chief immediate command of the Federal forces on the field during part of the first day's fighting. He then took part in the Battle of Chattanooga, and later, as commander of the Army of the Tennessee, accompanied Sherman in his march to the sea and through the Carolinas. He became brigadier general in the regular service in December, 1864, and from 1865 to 1874 was commissioner of the Freedmen's Bureau. He commanded the U.S. troops engaged in the Nez Percés War (1877) and in the Bannock War (1878); and was superintendent of the U.S. Military Academy (1880-81). He became major general in 1886; commanded the division of the Pacific and the Atlantic; and retired in 1895. Howard was the first president of Howard University, which was named for him, and in 1895 founded the Lincoln Memorial University at Cumberland Gap. He wrote: *Chief Joseph, of the Nez-Percés* (1881); *Gen. Zachary Taylor* (1892); *Isabella of Castile* (1894); *Fighting for Humanity; Henry in the War*; *Autobiography* (1907); *My Life and Experiences Among Our Hostile Indians* (1907); *Famous Indian Chiefs I Have Known* (1908).

**HOWARD, SIDNEY COE**, 1891-1939, American playwright, was born in Oakland, Calif., and was educated at Harvard University, where he was a member of George Pierce Baker's "47 Workshop." Among his plays, *They Knew What They Wanted* (1925) was awarded the Pulitzer prize; *Alien Corn* (1933) starred Katharine Cornell and won wide acclaim; and *The Silver Cord* (1926) was produced as a movie after a successful stage run. Other works include: *Ned McCobb's Daughter* (1926); *The Late Christopher Bean* (1932); *Yellow Jack* (1934); *Paths of Glory* (1935); *The Ghost of Yankee Doodle* (1938); *Madam, Will You Walk* (1939).

**HOWARD COLLEGE**. See COLLEGES AND UNIVERSITIES.

**HOWARD, FORT**, military post established in 1816 at Green Bay, Wis., on the site of the former French Fort La Baye (built in 1684) and the British Fort Edward Augustus. Each of the four corners of the log stockade had a tall blockhouse with a small cannon. The fort served as protection for JOHN JACOB ASTOR's fur trading operations and it helped to Americanize the French *habitants*; the garrison was called out in the Red Bird uprising (1827) and the BLACK HAWK WAR (1832). The fort was abandoned for a

new site in 1818 but reoccupied in 1820; the troops were withdrawn in 1841, but sent back in 1848; the final abandonment of the fort came in 1852.

BEATRICE WHITACRE

**HOWARD OF EFFINGHAM.** See NOTTINGHAM, CHARLES HOWARD.

**HOWARD PAYNE COLLEGE.** See COLLEGES.

**HOWE, EDGAR WATSON,** 1853-1937, American author and editor, was born in Treaty, Ind. He published and edited the *Atchison Daily Globe* (1877-1911) and *E. W. Howe's Monthly* (1911-37). The "folksy" philosophy of his editorials won him the name of "Sage of Potato Hill." He was the author of a melodramatic novel, *The Story of a Country Town* (1883), remarkable for its naturalistic technique, and of several volumes of aphorisms (*Country Town Sayings*, 1911) and inspirational essays.

**HOWE, ELIAS,** 1819-67, American inventor of the sewing machine, was born in Spencer, Mass. In 1835 he was an apprentice in a mill making cotton machinery in Lowell; later he went to Cambridge and Boston, where he became interested in trying to devise a sewing machine. He secured a patent on his lock-stitch machine, Sept. 10, 1846. Failing to have any financial success in the United States, he sold a machine together with his English rights to William Thomas, but no royalties were ever paid to Howe. Upon his return to the United States, he found his patent had been infringed. The long litigation (1849-54) was finally settled in his favor and Congress extended his patent for seven years in 1861. During the Civil War he raised and supported a Connecticut regiment and served as a private. In 1865 he built the Howe Machine Company at Bridgeport, Conn., and one of his machines was awarded the Paris Exhibition gold medal (1867). See SEWING MACHINE.

**HOWE, HENRY,** 1816-93, American publisher, compiler, and author, was born in New Haven, Conn., son of Hezekiah Howe, first publisher of Webster's *Dictionary*. He is best known for his valuable *Historical Collections of Ohio* (1847-1891). His other publications include *Historical Collections of Virginia* (1845); *The Great West* (1851); *Our Whole Country* (2 vols. 1861); *Times of the Rebellion in the West* (1867); and, with J. W. Barber, *Historical Collections of New York* (1841), and *Historical Collections of New Jersey* (1843).

**HOWE, JOHN,** 1630-1705, English Puritan clergyman and writer, born in Loughborough, Leicestershire. He was domestic chaplain to OLIVER CROMWELL until the latter's death, and later served as chaplain to Lord Massereene at Antrim Castle. The Act of Uniformity resulted finally in his going to Utrecht, where he remained until the Declaration of Indulgence (1687) allowed him to return to England. His most outstanding works are *The Blessedness of the Righteous* (1668) and *The Living Temple* (1671), considered a notable expression of Puritanism.

**HOWE, JOSEPH,** 1804-73, Canadian statesman, was born in Halifax, Nova Scotia, and learned the printing trade in his father's newspaper office. He was owner and editor of *The Nova Scotian* from 1828. Howe entered the provincial parliament in 1836, as member for Halifax, and continued in office until 1863. As leader of the Popular party, he advocated responsible government for Nova Scotia, finally granted in 1848. He was provincial secretary from 1848 to 1854, and visited England in 1850 to secure an imperial guarantee for the Intercolonial Railway. He became commissioner of railways in 1854. From 1860 to 1863 he was premier of Nova Scotia. Although he bitterly opposed the movement toward Confeder-

ation which led to the British North America Act of July, 1867, he joined Sir John Macdonald's cabinet in 1869, as president of the privy council. He died in 1873 a month after being appointed lieutenant governor of Nova Scotia.

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**HOWE, JULIA WARD,** 1819-1910, American writer and philanthropist, was born in New York, the daughter of Julia Cutler Ward, from whom she inherited her literary talent. She was educated privately. In 1843 she married Dr. SAMUEL GRIDLEY HOWE, and was associated with him in editing the *Boston Commonwealth*, an antislavery journal, and in his philanthropic work generally up to the time of his death. She read extensively in German philosophy and poetry, and Italian poetry and romance, and her home in Boston was one of the meeting places for the New England group of American men of letters and science. Though she did not cease to write, pure literature became subordinate to her constantly growing interest in social questions, such as woman's suffrage and educational and prison reform, on which she wrote and lectured extensively. Her poetry includes *Passion Flowers* (1854); *Words of the Hour* (1856); *Later Lyrics* (1866); *From Sunset Ridge* (1899). Her finest poem, "Battle-Hymn of the Republic," was written while visiting the camps near Washington during the Civil War, and was first published in the *Atlantic Monthly* (1861). She also wrote: *Trip to Cuba* (1860); *From the Oak to the Olive* (1868); *Sex and Education* (edited 1874); *Modern Society* (1881); *Life of Margaret Fuller* (1883); *Is Polite Society Polite? and Other Essays* (1899); and two dramas.

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**HOWE, MARK ANTONY DEWOLFE,** 1864- , American author and editor, was born in Bristol, R.I., and studied at Lehigh and Harvard universities. He was associate editor of the *Youth's Companion* (1888-93, 1899-1913), assistant editor of the *Atlantic Monthly* (1893-95), and vice-president of the Atlantic Monthly Company (1911-29). He is the author of numerous antiquarian studies, biographies, and memoirs, including: *Boston, the Place and the People* (1903); *Boston Common* (1910); *The Atlantic Monthly and Its Makers* (1919); *Barrett Wendell and His Letters* (1924; Pulitzer prize); *Classic Shades* (1929); *Holmes of the Breakfast-Table* (1939); *Tale of Tanglewood* (1946).

**HOWE, RICHARD, EARL,** 1726-99, English admiral, son of the second Viscount Howe, was born in London. In 1746, in command of the sloop *Baltimore*, he took part in an unsuccessful engagement with two French privateers off the coast of Scotland; and in 1755, in command of the *Dunkirk*, bore a part in the capture of two French vessels, *Alcide* and *Lys*, off the mouth of the St. Lawrence. He was with the expeditions sent against Rochefort in 1757, and Cherbourg in 1758, and in 1759 took part in the battle of Quiberon Bay. Soon after the outbreak of the American War for Independence, he was made a vice admiral, and in February, 1776, was appointed commander in chief of the British naval forces in America, to co-operate with his brother, the commander of the army, the two being commissioned "to treat with the revolted Americans and to take measures for the restoration of peace with the colonies." The colonists meanwhile having signed the Declaration of Independence, official negotiation was impossible and he co-operated with the army in the capture of New York, transported the English troops to the vicinity of Philadelphia (1777), forced the passage of the



U.S. NATL. MUS.  
Elias Howe, from  
an oil painting



CHICAGO HIST. SOC.

Julia Ward Howe



Delaware (1777), and defeated a French fleet under d'Estaing off Rhode Island (1778). He was relieved, at his own request (1778); was created a peer in 1782, resumed active service, and relieved Gibraltar in the same year. He was first lord of the admiralty (1783-88), and on June 1, 1794, off Ushant, he inflicted a crushing defeat upon the French. In 1796 he was made admiral of the fleet.

**HOWE, SAMUEL GRIDLEY**, 1801-76, American philanthropist, was born in Boston, Mass. He graduated from Brown in 1821 and from Harvard Medical College in 1824. He served (1824-30) in the Greek war for independence as surgeon in chief of the Greek fleet, and raised \$60,000 in the United States for the Greeks. After studying the methods employed in Europe for educating the blind (1831), he helped to found (1833), and directed until his death, the Perkins Institution for the Blind in Boston, pioneer institution of its kind in America. He invented or perfected various methods for instructing the blind. His most famous pupil was LAURA BRIDGMAN. He also founded (1844) at South Boston, and directed for the rest of his life, the first institute for idiots established in America. He took an active part in many other philanthropic enterprises; and with his wife, JULIA WARD HOWE, was an ardent opponent of slavery. During the Civil War he was a director of the Sanitary Commission; from 1865 to 1874 he was chairman of the State Board of Charities of Massachusetts, and in 1870 he was on the commission sent by President Grant to examine into the condition of Santo Domingo. See BLINDNESS, *Education and Rehabilitation*.

**HOWE, TIMOTHY OTIS**, 1816-83, American lawyer and legislator, was born in Livermore, Me. In 1839 he was admitted to the bar, and practiced law in Maine. In 1845 he moved to Green Bay, Wis., and was a judge of the circuit and supreme courts of Wisconsin (1850-55), and member (Republican) of the U.S. Senate (1861-79). He was a delegate to the International Monetary Conference in Paris (1881), and postmaster general of the United States in the cabinet of President Arthur (1882-3).

**HOWE, Sir WILLIAM**, 5th **VISCOUNT**, 1729-1814, English general, prominent in the American War for Independence, was born in London, and educated at Eton. He served under Wolfe at Quebec (1759-60), leading the forlorn hope of 24 men who cleared the way by which Wolfe reached the Plains of Abraham, and was also present at the siege of Havana (1762). Though a member of the British Parliament (1758-80), he opposed the measures that led the colonists to begin the Revolution. He was sent to America at the outbreak of hostilities, and was in immediate command of the British in the attack upon BUNKER HILL (June 17, 1775). In October, 1775, he succeeded General Gage in command of all the British land forces in America, outside of Canada. Forced by Washington to evacuate Boston (March, 1776), he went to Halifax, N.S.; late in June he appeared before New York City, and after winning the Battle of LONG ISLAND (Aug. 27, 1776), occupied the city. Meanwhile, with his brother, Admiral RICHARD HOWE, he had been commissioned to treat with the colonists with a view to effecting a conciliation, but the Declaration of Independence had already been adopted, and their efforts were unsuccessful. He defeated Washington at White Plains (Oct. 28, 1776); captured Fort Mifflin (Nov. 16, 1776); and moved by water against Philadelphia, late in the summer of 1777. He occupied Philadelphia (Sept. 26, 1777) after the battle of BRANDYWINE, defeated Washington at Germantown (Oct. 4, 1777), and then spent the winter in Philadelphia. His military conduct having been severely criticized in England, he was relieved at his own request, and in May, 1778, relinquished his command to Sir Henry Clinton. After reaching home, he demanded an inquiry by a committee of the House of Commons, which reported

in his favor. He was made a full general in 1793, and in 1799 became 5th Viscount Howe. See REVOLUTION, AMERICAN. For picture see FRANKLIN, BENJAMIN.

**HÖWEKLE, JOHANNES**. See HEVELIUS.

**HOWELL, WILLIAM HENRY**, 1860-1945, American physiologist, was born in Baltimore, Md., and studied at Johns Hopkins University. After serving on the faculty of Johns Hopkins (1884-89) he went to the University of Michigan as professor of physiology and histology (1889-92). He returned to Johns Hopkins as professor of physiology in 1893 and previous to his retirement in 1931 was also director of the school of hygiene and public health. He became famous for his research on the origin of red blood corpuscles and of blood-platelets, causation of the rhythmic beat of the heart, mechanism of sleep, and degeneration and regeneration of nerve fibers. He also participated in extracting and naming HEPARIN, a powerful anticoagulant present in liver.

**HOWELLS, WILLIAM DEAN**, 1837-1920, American writer, was born in Martin's Ferry, Ohio, the son of a country printer and druggist. At nine,



CHICAGO HIST. SOC.  
**Wm. Dean Howells**

he became a typesetter, but did not allow his work to interfere with wide and enthusiastic reading, started in his youth and continued throughout his entire life. Between 1851 and 1860, Howells was associated, as compositor, reporter, and editor, with a number of Ohio newspapers. His early writings, some of them poems for the *Atlantic Monthly*, began to appear during the final years of this period. A campaign life of presidential candidate Lincoln which he wrote and published in 1860 was rewarded by an appointment to the consulship in Venice, Italy (1861-65). He married Elinor Mead in Paris in 1862.

Upon his return to the United States, Howells assumed the first of three editorships—that of the *Nation* (1865). As editor of this magazine, of the *Atlantic Monthly* (1871-81) and of *Harper's Magazine* (1881-91), Howells became an outstanding advocate for a newly developed method of writing—realism—and an effective champion of realistic writers. His book, *Criticism and Fiction* (1891) collected some of his most notable pleas for the newer technique.

When, in 1872, his book *Their Wedding Journey* was published, Howells himself became a realistic novelist. This was the first of a series of some 38 novels, many of them highly successful in the eyes of both discerning critics and a large reading public. These fall chiefly into three classes. Some, such as *The Lady of the Aroostook* (1879) are comedies of manners. Some, such as *A Modern Instance* (1882) and *The Rise of Silas Lapham* (1884)—his best-known novel—are studies in character and ethics. And several, written after Howells had moved from Boston to New York (1885) and had come under the influence of Tolstoy, were novels of social and economic purpose, forerunners of modern novels such as Steinbeck's *Grapes of Wrath*. Books in this third group included, notably, *Annie Kilburn* (1888), *A Hazard of New Fortunes* (1890) and *The Quality of Mercy* (1892). *A Traveler From Altruria* (1894) is Howells' depiction, not of reality, but of a Utopian society.

Between 1900 and his death in 1920, Howells was generally recognized to be "the dean of American letters." As editor of "The Easy Chair" in *Harper's Magazine* during this entire period, he continued to guide literary taste. His last novel, *The Leatherstocking* (1916), returned, for its subject, to the Ohio frontier of his boyhood and proved that, at 79, he retained great skill as a fictionist.

Both as critic and creative writer, Howells exerted



U.S. ARMY SIGNAL CORPS

This 240 mm Howitzer in action on Italian front was largest mobile gun used in Italy by U.S. Army

great influence. He vigorously attacked romanticism and sentimentality, urging the substitution of concern on the novelist's part with the commonplace and of "the truthful treatment of material." He championed and to some extent shaped the careers of Mark Twain, Hamlin Garland, Henry James, Stephen Crane, Frank Norris, and Robert Herrick. And in his own works he set a fine example in his narrative method, his creation of lifelike characters, and his mature criticism of society, economics, and government in the United States.

WALTER BLAIR

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**HOWITZER**, a type of cannon intermediate between a gun and a mortar. A howitzer, in general, has a shorter tube than a gun of the same caliber, a more curved trajectory, and a lower muzzle velocity. It is able, therefore, to reach targets which cannot be reached by a gun, and correspondingly to occupy positions behind a hill or other natural cover which would be impractical for a weapon of flatter trajectory. Modern howitzers are designed to fire at a maximum elevation of approximately 69 degrees. The mortar is still shorter, and can fire at higher angles.

While guns, weapons of relatively flat trajectory, have been the traditional weapons of divisional artillery, the United States Army in World War II adopted the 105 mm howitzer as its principal weapon. Its bore is 22.5 caliber and its maximum range at 45 degrees is 12,150 yards. The muzzle velocity is 1,550 feet per second. The weight of the howitzer and carriage without accessories is 4,235 pounds. The ammunition is issued fused in the form of semifixed rounds. High explosive, chemical, target-practice and drill projectiles are issued. A complete round weighs 44 pounds. The United States also has howitzers of 75 mm, 240 mm, and 8-inch calibers. Similar weapons are utilized in other armies. See ARTILLERY; GUN; MORTAR.

DON RUSSELL

**HOWLAND, BAKER, AND JARVIS ISLANDS**, coral atolls near the Equator in the Pacific Ocean, claimed by the United States in 1935. Both American and British guano interests had exploited the uninhabited islands in the last half of the 19th century, but neither country again exhibited interest in the islands until they became of possible importance as air stations in transpacific flight.

Howland and Baker islands lie just north of the Equator some 1,900 miles southwest of Honolulu and 700 miles east of TARAWA ATOLL in the Gilberts. Neither of the islands has a safe anchorage, the low coasts being protected by dangerous fringing reefs. There is little vegetation, although Howland has a few small trees. A landing field was prepared for the flight of AMELIA EARHART from Lae in New Guinea in 1937—a flight that was never completed. A beacon on the island is called the Amelia Earhart Light.

Baker Island (area about 1 sq. mi.) has a lighthouse on its western end. Jarvis Island lies just south of the Equator, some 1,550 miles south of Honolulu, a little more than midway between the Hawaiian city and the COOK ISLANDS. Jarvis is used as an air and weather station. All three of the islands received token colonists from Hawaii in 1936 in support of the American claim advanced in 1935.

C. S.

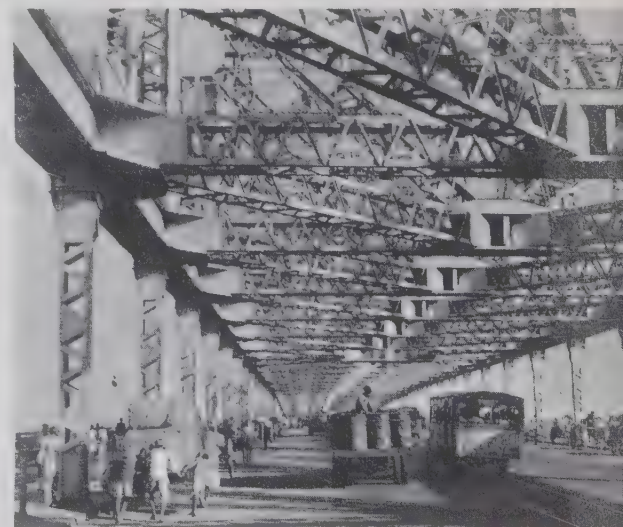
**HOWLER**, a MONKEY found in the forests of Central and South America. This animal belongs to the genus *Alouatta* and is remarkable for the dilation of its hyoid bone into a hollow drum. The drum, which communicates with the larynx, makes a conspicuous external swelling of the throat and gives prodigious power to the voice. The howler lives chiefly among the branches of trees and makes extraordinary leaps, grasping with the tail as well as the hands and often swinging by the tail alone. The thumb is well developed and the naked face is surrounded by a fringe of long hair.

**HOWRAH**, city, India, Bengal Province, Howrah District, opposite Calcutta, with which it is connected by a bridge. Howrah is the terminus of four railways. The Bengal Engineering College, occupying the buildings of a former theological college established in 1824, and the Royal Botanic Gardens, established in 1787, are in Sibpur, a suburb. Howrah is the center of the jute industry, with more than 60 mills. The population has more than doubled since 1881 because of the large industrial development. Pop. (1941) 379,292.

**HOWTH**, urban district on a peninsula stretching along the N side of Dublin Bay, Ireland, in County Dublin, nine miles NE of Dublin, which it serves as a seaside resort. The rocky promontory rises seaward to a height called the Hill of Howth (563 ft.), which has a castle and the picturesque ruins of an abbey. Howth is a port for yachts and fishing boats. Pop. about 4,000.

**HOXIE, VINNIE REAM**, 1847–1914, American sculptor, was born in Madison, Wis., and studied art under Bonnat in Paris and Majoli in Rome. The first woman sculptor to receive a commission from Congress, she executed statues of President Lincoln (Capitol rotunda) and Admiral Farragut (Farragut Square, Washington) for the United States government. Notable among her other works are a number of portrait busts of prominent men.

**HOY**, second largest island of the ORKNEY group, NE Scotland, Orkney County; area 53 sq. mi.; pop. (1940 est.) 1,000. Rectangular in shape, the island



INDIA INFORMATION SERVICES

Howrah and Calcutta are connected by this great cantilever bridge, first opened to traffic in 1943



is 14 miles long and 6 miles wide. Ward Hill (1564 ft.) is the highest point of the island. Hoy is separated from the northernmost tip of Scotland by Pentland Firth, and from Mainland, largest of the Orkneys (2 miles NE), by Hoy Sound. South Ronaldsay lies to the east across Scapa Flow. Along the Atlantic, the west coast of Hoy is precipitous. Longhope, a good harbor, is located at the southern end and is surrounded by the peninsula of South Walls.

**HOYLE, EDMOND**, 1672-1769, English writer on whist and other games. He gave lessons in whist, and is mentioned by Fielding and Byron. His *Short Treatise on Whist* (1742) has run through many editions, but his rules have been superseded. He also wrote *Quadrille, Piquet, Backgammon, and Chess* (1761).

**HRADEC KRÁLOVÉ**, German Königgrätz, town, NW Czechoslovakia, E Bohemia, situated on the Orlice River at its confluence with the Elbe (Labe), 79 miles E of Prague (Praha). The town has a Gothic cathedral, built in 1302. Hradec Králové is famous as a manufacturing center for musical instruments, including pianos, pipe organs, and fine violins. Small engines, gloves, candles, and confectionery are also manufactured. The battle of Sadowa, in which the Prussians defeated the Austrians, was fought there in July 1866. The Germans annexed the town in 1939, but it was restored to Czechoslovakia after World War II. Pop. 51,480.

**HRDLICKA, ALEŠ**, 1869-1943, U.S. anthropologist, was born in Humpolec, Bohemia. He came to the United States when he was 13 years old. Hrdlicka received degrees in medicine in New York and studied physical anthropology in Paris. He began anthropological research in 1896 as an associate with the New York State Pathological Institute. In 1899 he joined the American Museum of Natural History expeditions to Mexico and the American Southwest. He helped organize the division of physical anthropology at the U.S. National Museum in 1903, and became curator of that division in 1910. Hrdlicka became known for his research pertaining to the anatomical measurements and physiological standards of the chief stocks of the American people—Indian, Negro, and white. He also supported the theory that the American Indians are of Mongolian origin. He wrote *Ancient Man in North America* (1907), *Ancient Man in South America* (1912), and *Old Americans* (1925). He founded and edited the *American Journal of Physical Anthropology* after 1918.

**HROSWITHA or ROSWITHA**, 935?-?1000, German poet, was born of a noble Saxon family, and entered the Benedictine nunnery of Gandersheim, Brunswick. She wrote eight metrical legends, including that of *Theophilus*, the medieval *Faust*. She also wrote six comedies in prose in the style of Terence, but aiming at the transformation of heathen into Christian poetry and the inculcation of chastity. Hroswitha's *De gestis imperatoris Attonis I* celebrates in hexameters the exploits of Emperor Otto I. Another poem, *De primordiis et fundatoribus coenobii Gandersheimensis*, narrates the history of Gandersheim nunnery from its beginning to 919.

**HROZNÝ, BEDŘICH or FRIEDRICH**, 1879-1952, Czech archaeologist, was born in Lissa an der Elbe, Bohemia, and educated in Prague, Vienna, Berlin, and London. His intensive research in Assyriology, particularly in the field of Hittite, led to his success in identifying Hittite as an Indo-European language in 1915. His discoveries were summarized in *Die Sprache der Hethiter* (The Language of the Hittites, 1917). He was professor of archaeology at the University of Vienna from 1915 to 1918, and in 1919 was appointed professor of cuneiform and Oriental history at Karlsuniversität, Prague.

**HSIAO-FENGMAN DAM**. See SUNGARI RIVER; KIRIN.

**HSINGAN or HINGAN**, former province of China, in NW Manchuria, occupying that section of Inner Mongolia extending W from the Great Khingan



**Hradec Králové**, a Czechoslovakian manufacturing center, was the site of the Battle of Sadowa in 1866

Mountains. Its capital was Hulun (Hailar). In 1949 it was incorporated into the Inner Mongolian Autonomous Region.

**HSINKING**. See CHANGCHUN.

**HSÜAN-T'UNG**, reign title of Henry Pu-yi, 1906- , last emperor of the Ch'ing or Manchu dynasty of China and puppet emperor of Manchukuo, was elected emperor of China in 1908, with his father as regent. The boy abdicated in 1912 after the republic was established. He was allowed to remain in Peiping, 1912-24, and then lived in Tientsin under Japanese protection, 1924-31. He was appointed head of the Japanese puppet state of Manchukuo in 1932, and was crowned emperor of Manchukuo in 1934, under the reign name of Kang Teh. During the Japanese war crime trials in 1946 he said that he was forced by the Japanese to accept the rule of Manchukuo.

**HUACHO**, city and port, E central Peru, in Lima Department on the Huaura River, a railroad, and the Pan-American Highway, 20 miles N of Callao. The port exports cotton and sugar cane that are produced in the valley. Pop. (1950 est.) 16,039.

**HUAHINE ISLAND**. See SOCIETY ISLANDS.

**HUAINA-CAPAC, HUAYNA-CAPAC**, or **CCAPAC**, c. 1450-1525, one of the great Incas of Peru, during whose reign the empire attained its greatest splendor. He was succeeded by his sons Huascar and Atahualpa. Atahualpa fought his brother and won Peru from him but lost the kingdom to Pizarro. See ATAHUALPA; HUASCAR; INCA; PERU.

**HUALIEN or HWALIEN**, Japanese Karenko, city, E central Formosa, 55 miles S of Ilan, 2 miles N of the mouth of the Keren River. Hualien is the northern terminus of a rail line that runs south of Taitung. The city has an airport. Hualien uses the modern harbor facilities of Milun, 2 miles north. Principal industries of the city include an aluminum and nickel smelter, a chemical plant that produces nitrogen compounds and ammonia, and an electrical appliance factory. Pop. 29,455.

**HUALLAGA RIVER**, in Peru, rises near the Cerro de Pasco, flows N on the E side of the Central Cordilleras, breaks through the range at the gorge of Chasuta, and enters the Marañon, itself a tributary of the Amazon River. The Huallaga's total length is about 650 miles. The river serves as a transportation medium for the cotton grown along its banks.

**HUAMBO**. See NOVA LISBOA.

**HUANCVELICA**, a department of central Peru, lying entirely within the Cordilleras; area 8300 sq. mi. It contains little land fit for agriculture. The mountains are rich in minerals, especially silver and quicksilver. The capital is the city of Huancavelica (pop. 9594), which is situated at an altitude of more than 12,000 feet and is the center of a mining area. Pop. (1950 est.) 305,619.

**HUANCAYO**, city, Peru, capital of Junín Department, a typically Indian town in the valley of the

Mantaro River. The Indian market, held each Sunday morning, is one of the most famous in South America. Near by is the famous Franciscan monastery of Ocopa. The Peruvian government operates here the Huancayo Magnetic Observatory, one of the most important of its kind in the western hemisphere. Pop. (1948 est.) 152,407.

**HUÁNUCO**, department, central Peru; bounded on the N by the departments of Libertad, San Martín, and Loreto; on the E by Loreto; on the S by Junín and Lima; and on the W by Ancash; area 15,430 sq. mi.; pop. (1948) 309,780. The department lies in a belt of forested mountains, rich in minerals. It is drained by the Huallaga River. Crops and livestock to support the Indian population are produced in the long valleys between the mountain ranges. Huánuco is the capital.

**HUÁNUCO**, river port, Peru, capital of Huánuco Department, on the wooded eastern slope of the Andes and the Huallaga River. The city is a market center for the mountain valleys of the interior. The church of San Francisco is a notable colonial landmark. Pop. (1948 est.) 36,536.

**HUARÁS**, city, Peru, capital of Ancash Department, on the Huarás River; 190 miles NW of Lima. Located at an altitude of 10,000 feet, the city is surrounded by snow-capped peaks making it one of the most picturesque spots in South America. It has noteworthy ruins from the Inca civilization. Coffee, cotton, and sugar are grown in the vicinity, and there are gold, silver, and copper mines near by. Pop. (1947 est.) 13,975.

**HUASCAR**, c. 1495–1533, Peruvian Inca. His father decreed that he should share the kingdom with his younger brother, Atahualpa. The latter coveted the entire kingdom, however, and Huascar was defeated in battle, and taken prisoner. When the Spanish General Pizarro invaded the country, ATAHUALPA, fearing that his brother might be restored to his kingdom, had him drowned.

**HUASCARAN, NEVADO DE**, mountain, Peru, department of Ancash, one of the spectacular peaks (22,205 ft.) of the Andes.

**HUAYNA-CAPAC**. See HUAINA-CAPAC.

**HUBBARD, ELBERT**, 1859–1915, American author and publisher, was born in Bloomington, Ill. He founded at East Aurora, N.Y., an establishment called "The Roycroft Shop" for the publication of artistically printed and bound books, both new and reprinted (see ROYCROFT). Hubbard was also the founder and editor of the *Philistine*, a monthly magazine of protest, which consisted mainly of his own homey views on art and life. *The Fra* (1908–17) was similar in content but was never as successful as the *Philistine*. Hubbard's best known works were his adulatory *Little Journeys to the homes of the great and A Message to Garcia* (1899), commemorating a minor hero of the Spanish-American War. The inspirational *Message*, stressing loyalty, devotion, and persistence, appealed to American industrialists as an ideal philosophy for their employees, and some 40,000,000 copies of the essay were distributed among American workers. Professedly an exponent of the radicalism of William Morris, Hubbard never really understood the Englishman's aims and remained a staunch conservative to the end of his life. He died in the sinking of the *Lusitania*.

**HUBBARD, GARDINER GREENE**, 1822–97, American lawyer and businessman, was born in Boston and studied at Dartmouth College and Harvard Law School. In addition to practicing law in Boston and Washington, Hubbard was founder and first president of the Clarke Institution for Deaf Mutes at Northampton (1867–77), and directed the commercial development of Bell's telephone after 1875. His studies on postal service and telegraphy (1867–76) brought him to the attention of President Grant, who named him head of a commission investigating mail transportation in 1876. He was

founder and first president of the National Geographic Society (1888–97).

**HUBBARD, GURDON SALTONSTALL**, 1802–86, American pioneer merchant in Chicago, was born in Windsor, Vt. In 1828 he purchased the American Fur Company's interests in Illinois and several years later founded the first meat packing house in Chicago. To facilitate shipping, he established the Eagle Line, connecting Chicago with Buffalo and the upper lakes. The city became a focal point for commerce when a canal connecting Lake Michigan and the Illinois River was built after he helped push a canal bill through the state legislature. He also started the first bank in Chicago.

**HUBBARD, ROBERT CAL**, 1900–, American football player and baseball umpire, was born in Keyteville, Mo., and graduated from Geneva College. He played college football at Centenary and Geneva, professional football with the New York Giants (1927–28, 1936) and Green Bay Packers (1929–33, 1935). Hubbard, considered one of the greatest linemen of all time, was all professional tackle three years (1931–33). He began his baseball umpiring career in 1928 and was an American League umpire after 1936.

**HUBBELL, CARL OWEN**, 1903–, American baseball player, member of Baseball Hall of Fame, was born in Carthage, Mo. With the New York Giants throughout his major league career (1928–42), Hubbell, a lefthanded pitcher, won 253 games. He led the National League in won and lost percentages five years, and in earned run averages, three years. In the 1934 All Star game, he struck out in succession Ruth, Gehrig, Foxx, Simmons, and Cronin. Named the league's most valuable player in 1933 and 1936, he was elected to the Hall of Fame in 1947.

**HUBBLE, EDWIN POWELL**, 1889–1953, American astronomer, was born in Marshfield, Mo., studied at the University of Chicago, and was a Rhodes scholar at Oxford University. In 1919 he joined the staff of the Mount Wilson Observatory and won renown for his study of the spiral nebulae and for his classification of the extragalactic systems. His investigations re-established the theory of "island universes," for he proved the existence of galaxies beyond the galaxy to which the sun belongs. Furthermore, from the radial velocity interpretation of the red-shifts of spectral lines he and his co-worker, Milton L. Humason, found that all the nebulae were apparently receding from the sun with speeds proportional to their distances. This is the basis of the theory of an expanding universe postulated in the cosmogonies of WILLEM DE SITTER, EDDINGTON, and others; Hubble suggests, however, that the red-shifts may possibly have another interpretation than as a velocity of recession. He wrote *The Realm of the Nebulae* (1936) and *The Observational Approach to Cosmology* (1937).

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**HUBERT, SAINT**, d. c. 727, bishop of Maestricht and Liege. He lived a worldly life at the court of the Frankish king Theuderich and later at the court of Pepin of Herstal, but after the death of his wife entered a monastery. He was appointed bishop of Tongern and later bishop of Maestricht and Liège (708). According to a legend he was converted during a hunt by seeing a stag with a luminous cross upon his head. He is the patron saint of hunters and his feast day is November 3. A breed of staghounds was named after him.

**HUBERT DE BURGH**, d. 1243, English justiciar from 1215 to 1232, first served Richard I, later supported John's struggle against the barons and Prince Louis of France. He was responsible for the naval victory of Dover (1217), and succeeded William Marshal as co-regent for Henry III (1219). For 13 years Hubert was England's chief ruler, maintaining a policy of "England for the English" which aroused the resentment of foreign landholders and clergy.



## Hubli

Blamed by Henry III for Henry's failure in France (1229), he was disgraced and imprisoned in 1232. He joined Richard Marshal's rebellion the next year, and in 1234 was included in the general pardon of Richard's supporters, resuming his title (earl of Kent) and lands, though never returning to public office.

**HUBLI**, city, India, Bombay Province, Dharwar District, 15 miles SE of Dharwar (town). Hubli is a railway junction, and the center of an important cotton, grain, and salt trade. There are cotton processing and weaving factories, a railway workshop, and soap and manure works. Hubli was an early English trading station, and is still a military station. Pop. (1941) 95,512.

**HUCHOW**. See **WUHING**.

**HUCKLEBERRY**, a low, branching shrub common in acid soils throughout eastern North America. These plants have entire or serrate leaves and racemes of small flowers. Their edible, berry-like fruits, ripening in July or August, are blue or black in color. Huckleberries grow chiefly on wooded land in sandy soils. There are no cultivated species and all fruits used as human food are obtained from the wild plants. The true huckleberry belongs to the genus *Gaylussacia*, while blueberries, sometimes improperly called huckleberries, belong to the genus *Vaccinium*.

**HUCKLEBERRY FINN, THE ADVENTURES OF**, by SAMUEL LANGHORNE CLEMENS (Mark Twain), a story of Mississippi River life in the 1850's, is a sequel to the author's *Adventures of Tom Sawyer*. Begun in 1876, the book was first published in an English edition in December, 1884, the American edition appearing a few days later. It deals with the same materials as *Tom Sawyer*, but in a more realistic, more authentic manner. Like the earlier novel, it was designed as a book for children, but it was also a purposeful, affectionate reconstruction of the frontier life which had been an important factor in the genesis of Clemens' writing, and which he now saw rapidly disappearing.

The action begins in the little river town of St.



L. W. BROWNELL

## Huckleberries

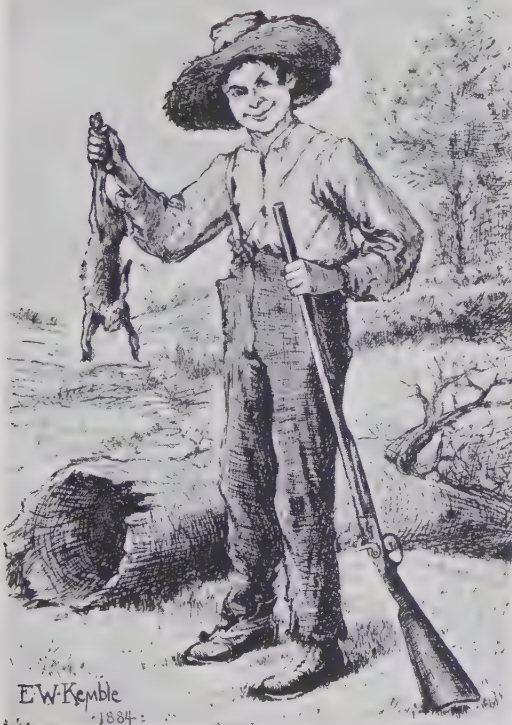
Petersburg, the scene of *Tom Sawyer*. Huckleberry Finn, the son of the village drunkard, escapes from his father's maniacal persecution, and with Jim, a runaway Negro slave, floats down the Mississippi on a raft. Encounters with rivermen, rogues, rascals, a decadent tragi-comic plantation family, lynchers, small-town gentry, and backwoods farmers, compose a powerful, vivid picaresque narrative which is accepted not only as a classic of juvenile literature but as one of the great naturalistic novels of the world.

**HUCKNALL**, formerly **Hucknall Torkard**, urban district, E central England; Nottinghamshire, six miles NW of Nottingham. It was the English home of Lord Byron, and his tomb is in the Church of St. Mary Magdalene. There are coal mines near by, and Hucknall has hosiery mills. Pop. (1950 est.) 18,500.

**HUDDESFIELD**, municipality, county, and parliamentary borough, N central England, Yorkshire, in the West Riding, on the Colne River; 16 miles SW of Leeds and 190 miles NW of London. Buildings of interest are the parish church of St. Peter, founded in 1100; the cloth hall (erected in 1874); and the art gallery. Huddersfield College was opened in 1838; Longwood School was founded in 1731. Important textile manufactures are located here, including silk and cotton spinning, woolen worsteds, tweeds and mixed goods, and silk fabrics. There are iron foundries, engineering plants, and coal mines. Huddersfield was one of the Midlands towns whose war industries were bombed by German airmen during World War II. Pop. (1951 est.) 128,520.

**HUDSON, HENRY**, d. 1611, English navigator, of whom nothing certain is known before April, 1607, when he started on the first of two voyages for the Muscovy Company to discover a NORTHEAST PASSAGE to Japan and China. In his first voyage he vainly attempted to pass between Greenland and Spitsbergen, and in the second voyage (1608) he reached Novaya Zemlya—probably the most northern point reached by any explorer at that time. His most successful and famous voyage was that of 1609, undertaken for the same object, but on behalf of the Dutch East India Company. He sailed from Amsterdam on March 25 in the *Half Moon*, of 80 tons burden, with a crew of 18 or 20. He reached Novaya Zemlya again; but the crew becoming quarrelsome, he turned westward and crossed the Atlantic Ocean, sighting land in the latitude of Nova Scotia. He then steered southward, and discovered the mouth of the river (see **HUDSON RIVER**) which now bears his name, and sailed up its waters for 150 miles, to the present site of Albany. See **NORTHWEST PASSAGE**.

Hudson sailed upon his last voyage in 1610, in the *Discoverie*, and reached Greenland. Steering westward, he discovered the strait now known as Hudson Strait, passed through it, and entered the great body of water which has received the name of **HUDSON BAY**. Here his ship was frozen in for the



Huckleberry Finn



CHICAGO HISTORICAL SOCIETY

### Landing of Henry Hudson on shore of river which bears his name

winter, and in the spring, when the ship was set free of ice, after a winter of the severest hardship and starvation, the crew mutinied. Hudson and eight others were cast adrift in a shallop and their fate remains unknown to this day. The mutineers encountered some Eskimos, who attacked and killed many of them; a few survivors finally reached England, and were imprisoned.

The practical results of Hudson's voyages were the establishment of the Spitsbergen whale fisheries and the Hudson Bay fur trade, and the settlement of New York by the Dutch. He is credited with being the first to record an observation of a sun spot. His name passed into the folk lore of the Hudson River, some of the popular beliefs concerning him and his exploits being told by Washington Irving. N. S.

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**HUDSON, HENRY NORMAN**, 1814–66, American Shakespearean scholar, was born in Cornwall, Vt., and was graduated from Middlebury College (1840). He entered the Protestant Episcopal ministry; was rector in Litchfield, Conn.; and was for some years editor of *The Churchman*. He attained a prominent place among Shakespearean scholars; prepared an annotated edition of Shakespeare's *Works* (11 vols., 1851–56); and wrote *Lectures on Shakespeare* (2 vols., 1848), and *Shakespeare: His Life, Art, and Character* (2 vols., 1872). He also published *A Chaplain's Campaign with General Butler* (1865); *Studies in Wordsworth* (1884).

**HUDSON, MANLEY OTTMER**, 1886– , American jurist, was born in St. Peters, Mo., and studied at William Jewell College and Harvard University. After teaching law at the University of Missouri (1910–19), he went to Harvard Law School and became Bemis professor of international law (1923). A member of the legal section of the League of Nations Secretariat (1919–23) and of the Permanent Court of Arbitration (1933–45), he was a judge of the Permanent Court of International Justice (1936–46) and chairman of the UN International Law Commission (1949). He wrote several texts on international law.

**HUDSON, WILLIAM HENRY**, 1841–1922, British nature writer, was born in Argentina of American parents. He settled in England in 1874 and became a British citizen in 1900. His best known works are the impressionistic romances of the tropical jungle, *The Purple Land* (1885) and *Green Mansions* (1904); a

nostalgic record of his boyhood in Argentina, *Far Away and Long Ago* (1918); and *A Shepherd's Life* (1910), typical of his many books on the English down country. He was also known as an ornithologist, his works in this field including *Argentine Ornithology* (in collaboration with P. L. Slater, 1888), *British Birds* (1895), and *Birds of La Plata* (1920).

**HUDSON**, town, NE Massachusetts, in Middlesex County, on the Assabet River and the Boston and Maine Railroad, three miles N of Marlborough and 28 miles W of Boston. Hudson was settled about 1700 and incorporated separately from Marlborough in 1866. The manufacture of shoes, begun in 1816, is the most important industry; other products are plastic, machinery, and worsteds. Pop. (1950) 8,211.

**HUDSON**, city, SE New York, county seat of Columbia County, on the E bank of the Hudson River, the New York Central Railroad, and U.S. Highway 9; about 33 miles S of Albany and 115 miles N of New York City. Although the land was bought from the Indians in 1662, permanent settlement was not made here until 1783. The first settlers, who were from Rhode Island, named the community for Henry Hudson, who is said to have moored the *Half Moon* here while he explored the upper Hudson in a smaller boat. Hudson's city charter, granted in 1785, is one of the oldest in the state. Before the War of 1812, Hudson had a considerable whale, seal, and West Indies trade. Today the major industries make cement, matches, textiles, clothing, and ginger ale. Pop. (1950) 11,629.

**HUDSON BAY**, a great gulf or inland sea in NE North America, bordering Quebec, Ontario, Manitoba, and the Northwest Territories. It is completely land-locked but is connected with the Atlantic Ocean by Hudson Strait, and with the Arctic Ocean by Foxe Channel and Foxe Basin and Fury and Hecla Strait. Hudson Bay extends about 900 miles from north to south including James Bay (350 mi.) and reaches to within 300 miles of Lake Superior; it is about 600 miles wide, and has an area of about 400,000 square miles. The average depth is 420 feet. Its watershed extends from the St. Lawrence Valley on the south, the Mississippi Valley on the southwest, and the Rocky Mountains on the west. The ice-locked eastern shores of the bay are high, rocky, and bordered by small islands; the west coast is flat, low, and free from shoals. Among the numerous rivers which empty into James and Hudson bays, the three largest are the Nelson, the Churchill, and the Severn. The climate about Hudson Bay is severe except for a short summer when the weather is pleasant and bracing. Hudson Strait, which connects the Bay with the Atlantic Ocean, is about 450 miles in length. It has no islands or rocks to hinder navigation and because of high tides never freezes over. Hudson Bay seldom is frozen for more than a few miles from the shore, but both the Bay and the Strait are full of Arctic ice floes and bergs which make navigation unsafe at certain times. Navigation is safest from June to October.

Mineral deposits of iron, coal, copper, mica, slate, zinc, silver, and gold are known to exist in the region, but little exploitation has taken place. The fishing industry is profitable and whaling has been carried on for many years. Fleets of steam





NATIONAL FILM BOARD OF CANADA

**Chief Hudson Bay Settlement is Churchill, fur trading center of the region. Two Eskimos, left, stand at entrance to igloo in town of Baker Lake**

whaling ships hunt white whales, which may be taken during the months from June to October. Since the 17th century, fur trading has been profitable. The main headquarters are at Churchill, the chief settlement on Hudson Bay, located on the west coast of the Bay in northeastern Manitoba. In 1929, the Hudson Bay Railway reached Churchill opening a new route for the shipment of grain from the interior of Canada to Europe; utilizing this railway and the port at Churchill instead of the St. Lawrence River, some 1,200 miles is lopped off the route to Europe. Through the use of ships equipped with radar and modern compasses, the danger from drift ice is minimized. Wireless communication connects three bases: Port Burwell at the Atlantic entrance, Wakeham Bay on Hudson Strait, and Nottingham Island at the entrance to Hudson Bay.

Hudson Bay was discovered by HENRY HUDSON in 1610, and in 1670, by royal charter, the "Governor and Adventurers of England, trading into Hudson Bay," were granted "the whole trade of all those seas, straits, and bays, rivers, lakes, creeks, and sounds, in whatsoever latitude they shall be, that lie within the entrance of the straits commonly called Hudson's Straights." During the French wars the bay was the scene of constant fighting, and for 17 years, with the exception of Fort Albany, it remained in French hands, being restored to the English in 1714, after the Peace of Utrecht. See HUDSON'S BAY COMPANY; NORTHWEST TERRITORIES. F. C. W.

**HUDSON BAY TERRITORY.** See NORTHWEST TERRITORIES.

**HUDSON FALLS,** village, E New York, in Washington County, on the Hudson River, the Delaware and Hudson Railroad, and U.S. Highway 4; about 50 miles N of Albany. Hudson Falls, a papermaking center, was settled in 1768. Until 1910, it was known as Sandy Hill. Wallpaper, paper and paper products, and iron and brass products are the chief industries. Pop. (1950) 7,236.

**HUDSON RIVER,** in New York, one of the most beautiful and important rivers in the United States, rises in the Adirondack Mountains near Mount Marcy, 4,322 feet above the level of the sea, in head streams which are the outlets of many mountain lakes. In its upper course the river falls rapidly; from its source to North Creek, about 52 miles, its rate of fall is 64 feet per mile; from there to the mouth of the Sacondaga, 14 feet per mile. Below that point the river turns sharply and follows an easterly course for about 12 miles, marked by rapids and falls of great

beauty. Below Glens Falls it turns south to flow into New York Bay and the Atlantic Ocean. The total length is about 300 miles and the area of the river basin is 13,366 square miles.

In its upper reaches the Hudson cuts through the ridges of the Appalachian Range; in the lower valley, because of a gradual subsidence, tidewater extends northward 150 miles to Troy, the head of navigation; these conditions unite in determining the peculiar beauty of the river and its economic importance as a trade route. The tributaries, among which are the Sacondaga, Mohawk (145 mi.), Walkill, and Esopus, drain chiefly the western shore. Below Albany, the river widens from one-half to one and one-half miles; passes within view of the Catskill Mountains; enters the Highlands, which rise abruptly from the water to a height of 1,600 feet; widens to four miles at Tappan and Haverstraw bays; and about 20 miles above New York City reaches the Palisades, a perpendicular wall of rock 300 to 500 feet in height, which constitutes one of the chief beauties of the river. The principal towns and cities along its borders are Glens Falls in the north; Cohoes, Troy, and Albany near the mouth of the Mohawk; Hudson, Catskill, Kingston, Poughkeepsie, Newburgh, West Point (seat of the U.S. Military Academy), Peekskill, Haverstraw, Ossining, Nyack, Tarrytown, and Yonkers along the lower course; New York, Hoboken, and Jersey City at its mouth.

The Hudson supplies considerable waterpower through a dam at Spiers Falls which generates power transmitted by electrical machinery to Schenectady, Albany, Troy, Amsterdam, and other cities, and utilized extensively in the coal mining industry of Pennsylvania. Since the settlement of the region, the river has been an important route for commerce. A large volume of fuel and building materials is carried on canal boats, penetrating westward through the New York State Barge Canal and other waterways. The New York Central Railroad traverses the shores providing widely used routes to the north and west. Along the lower course of the river are many fine residences and country estates.

Traffic across the river is handled by bridges, ferries and tunnels. The George Washington Bridge (1931) connects Manhattan with Fort Lee, N.J.; the Bear Mountain Bridge (six miles north of Peekskill) extends from Anthony's Nose on the east bank to Bear Mountain Park on the west bank; the Mid-Hudson Bridge crosses at Poughkeepsie; the Rip Van Winkle Bridge spans the river about 25 miles



NEW YORK STATE DEPT. OF COMMERCE

### Hudson River, with Storm King Highway above railroad at right

south of Albany, connecting Hudson on the east, with Catskill on the west, opened in 1935; the Albany-Rensselaer is a movable bridge; farther up, Troy, the head of navigation, is connected with Cohoes and Watervliet by bridges. Several tunnels connect New York City with New Jersey (see NEW YORK, city). The river also furnishes much of the water supply of New York City through its various tributaries (see AQUEDUCT). The lower Hudson waterfront is extensively developed as a gigantic wharf, bordered with piers used by shipping interests.

**History.** The history of the Hudson River begins with its discovery in 1523 by Verrazano, and its exploration in 1609 by HENRY HUDSON, for whom it is now named. The Dutch used it as a thoroughfare for colonization and as early as 1614 established a fur post at Albany. The Walloons, driven out of the Netherlands, founded a new colony at Kingston in 1660. With the conquest of New Amsterdam in 1664, the British rapidly expanded their settlements along the river which was the principal artery for all traffic going upstate. The construction of the ERIE CANAL increased the importance of the Hudson by funneling commerce from the Great Lakes and the western hinterlands into New York harbor.

From the viewpoints of the railroads, the Hudson was a barrier to transportation. Western lines were stopped on the Jersey shore of the Hudson to allow passengers a ferry journey into New York City. The river was too wide for a railroad bridge and not until 1910 did the Pennsylvania Railroad succeed in digging a tunnel entrance for its trains to rival the monopoly of the New York Central.

The Dutch name of North River (to distinguish it from the Delaware or South River) is still retained on the west harbor front of Manhattan Island. During the American Revolution the Hudson, because of its strategic importance, was the scene of the battles of Harlem Heights, Stony Point, and Peckskill, and witnessed the campaign of Burgoyne and the treason of BENEDICT ARNOLD. In 1807 ROBERT FULTON's first successful experiment in steamboat navigation was made on this river.

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**HUDSON RIVER SCHOOL.** See AMERICAN PAINTING.

**HUDSON RIVER VEHICULAR TUNNEL.** See NEW YORK, city; TUNNEL.

**HUDSON STRAIT.** See HUDSON BAY.

**HUDSON'S BAY COMPANY,** was incorporated May 2, 1670, as "The Governor and Company of Adventurers of England trading into Hudson's Bay." A Royal Charter granting rights to "sole trade and commerce" within the entrance to Hudson

Strait was bestowed by King Charles II upon Prince Rupert and an imposing array of courtiers. The real founders of the company, however, were two adventurous French explorers, PIERRE ESPRIT RADISSON and his brother-in-law Medard Chouart des Groseilliers, who had previously explored a great region west of Lake Superior. The territory granted to the company, including all regions drained into Hudson Bay, was called Rupert's Land for Prince RUPERT, the company's first governor. The company still trades under its original charter, supplemented by others in the course of the years, and is one of the

oldest business firms in the world.

From 1670 until 1713 the company's right to trade in Hudson Bay was challenged by the French. Skirmishes in the wilderness, burned forts, bitter cold, and captured ships marked the intermittent warfare carried on by a handful of soldiers, coureurs du bois, and sailors. After Hudson Bay finally became British in 1713, the French continued to push westward in defiance of the Royal Charter, and traded with the Indians right in their own land. When Canada became British in 1763, French-Canadian fur traders united in small groups. By 1784, these had amalgamated in the North West Company. The Nor'westers pushed the trade into the prairies, into the Athabasca, and beyond the Rockies. After years of bitter fur trade war in 1821 the two great fur trade companies united in the Hudson's Bay Company. From 1821 to 1869 the company enjoyed a vast monopoly in the fur trade. They kept peace with the Indians, discouraged the use of spirits as an article of trade, and governed the country. Each year a small body of these commissioned officers of the fur trade met at Fort Garry, Norway House, or York Factory. This council of the northern department of Rupert's Land made laws for the country from Labrador to the Oregon.

The settlement of the Red River by Lord Selkirk in 1811 is part of the Company's history. Selkirk was one of the largest stockholders in the Company and sought to compete with the rugged North West Company, which regarded Selkirk's approach as the Hudson's Bay threat to its western enterprises. The North West Company harried the new colonists and induced many to desert. In the course of time many more dissatisfied Red River settlers took advantage of the proximity to Minnesota and abandoned allegiance to the Hudson's Bay Company for American opportunities. The early settlement of Minnesota around Ft. Snelling is linked with the history of the Hudson's Bay Company.

In 1869, two years after the Confederation of the Dominion of Canada, the company transferred its rights to Rupert's Land to the Crown, by a deed of surrender. In return the company received \$1,500,000, and one-twentieth of the land within the fertile belt.

The company, besides its many fur trading posts scattered throughout Canada, conducts an extensive real estate department for its seven million acres received by the deed of surrender and operates many large retail stores in the western provinces. See FUR TRADE.

**HUE,** city, French Indochina, in the Viet Nam Republic, capital of Annam, on the Hué River, about nine miles inland from the China Sea, some 340 miles SSE of the Viet Nam capital of HANOI. Hué is



on the coastal highway and railway, and has small glass and ivory handicraft industries. It was for several centuries the capital of the Annamite emperors; the tombs of many emperors attest its former glory. The old city walls contain the palace, but the business district and the homes of the French officials are outside the walls. In early 1947 a Viet Nam siege of the town was lifted by a French relief force. Pop. (1938) 13,056, including several hundred Europeans.

**HUE AND CRY**, a term used for the ancient English process of summary pursuit and arrest of a felon caught in the act. It was the duty of every lawful citizen to raise "hue and cry," and to join in it. A felon thus caught by the pursuers with the evidence of his crime upon him was summarily convicted and executed. The statutes relating to hue and cry were repealed in 1827, and in 1857 were re-enacted in a modified form.

**HUELVA**, province, SW Spain, bordering on the Gulf of Cádiz and the Portuguese frontier, with the provinces of Badajoz on the N and Sevilla on the E; area 3,906 sq. mi.; pop. (1949 est.) 369,700. The northern part of the province lies in the Sierra Morena, ranging in altitude from 2,000 to 5,000 feet. The south is a plain with coastal lowlands, and in the extreme southeast at the mouth of the Guadalquivir are the flat wastelands called Las Marismas. Forests in the north and along the Guadiana River in the west yield chestnuts and cork. The chief crops are cereals, olives, grapes, and citrus fruits. Cattle, sheep, and hogs are raised in the mountain pastures. Great quantities of copper ore are mined in the Rio Tinto area. The capital is Huelva.

**HUELVA**, ancient **Onuba**, town, Spain, capital of Huelva Province, on the left bank of the Odiel River, about 10 miles from the Atlantic Ocean. Features of interest include a former mosque, now the church of San Pedro, and a Roman aqueduct. Near by in 1484 Columbus sought shelter in the Franciscan monastery of Santa Maria de la Rabida. Huelva exports large quantities of copper ore and pyrite derived from the Rio Tinto and Tharsis mining districts. There are large fisheries and factories for salting and preserving fish. Pop. (1949 est.) 64,632.

**HUERTA, VICTORIANO**, 1854-1916, Mexican general, dictator, and president, was born of Indian parentage, and was graduated from the Military Academy of Chapultepec (1876). His early career included eight years on the Mexican military map commission; 10 years (1890-1900) on the general staff, and several years in Sonora, spent in suppressing revolts of the Yaqui Indians. As a reward for his services, he was made brigadier general. He safely escorted former President Porfirio Díaz to Vera Cruz, after the latter's resignation (May 25, 1911). He then entered the service of President Madero, but later he combined with Gen. Felix Díaz to make Madero a prisoner and force him to resign. Huerta, being minister of war, and the strongest man in sight, became provisional president. The U.S. government refused to recognize his title, however, and gave moral and material support to his enemies in the field. (See MEXICO.) In 1914 he was forced to resign and retired to Barcelona, Spain. In April, 1915, he went to New York, where he was arrested, charged with violating American neutrality; but he died at El Paso, Tex., before being brought to trial.

**HUESCA**, province, N Spain, a part of ancient Aragon, bounded on the N by France, NW by Navarre, SW and S by Zaragoza, and E by Lérida; area 5,849 sq. mi.; pop. (1949 est.) 239,397. The northern half of the province is dominated by the Pyrenees (Pico de Aneto, 11,167 ft.; Mt. Perdido, 10,997 ft.), the southern half by the plateau of Aragon. The province is included in the Ebro basin and is drained by the Cinca, the Aragon, and the Gallego rivers, all of which flow south to join the Ebro. The climate is dry, and agriculture depends in large part upon irrigation. The mountain slopes are wooded, and

where pasture is good cattle, sheep, and pigs are raised. The chief crops are wheat, grapes, olives, and vegetables. The minerals include small deposits of copper, lead, iron, cobalt, lignite, salt, and building stone. Industry is relatively undeveloped, and the region suffers from lack of transportation facilities. A branch line from the Zaragoza-Barcelona railway to Huesca is connected, through Jaca, to Laruns in France, crossing the Pyrenees by the pass of Somport.

**HUESCA**, ancient **Osca**, town, Spain, capital of Huesca Province, on the Isuela River, 35 miles NNE of Zaragoza. A bishop's seat, it has a Romanesque church (12th century) and a Gothic cathedral (15th century). There is trade in fruits, vegetables, cereals, and wines; and cloth, leather, pottery, and bricks are manufactured. Quintus Sertorius, Roman general, was murdered here in 72 B.C. Huesca was under Moorish domination from 713 to 1096 when it was regained by Pedro I as a result of the battle of Alcoraz; it was the capital of Aragon until 1118. The old palace of the kings of Aragon is still extant. A university founded here in the middle of the 14th century was amalgamated with the University of Zaragoza in 1845. Huesca was the scene of fighting during the Spanish Civil War (1936-39). Pop. (1949 est.) 20,100.

**HUGER, BENJAMIN**, 1806-77, American soldier, was born in Charleston, S.C. He was graduated from West Point (1825), and served under Gen. Winfield Scott in the Mexican War. He entered the Confederate army in the Civil War (1861) as brigadier general, and was promoted to major general. After the Battle of Malvern Hill (July, 1862) he was relieved of his command for failing to intercept the enemy.

**HUGGINS, Sir WILLIAM**, 1824-1910, English astronomer, was born in London. He was educated privately and was early attracted to the study of chemistry, magnetism, and allied branches of physical science. Having in 1855 built an observatory at Upper Tulse Hill, near London, he devoted himself to the study of the physical constitution of stars, planets, comets, and nebulae. He was stimulated by the research of Bunsen and Kirchhoff, which he zealously continued over a long period. He photographed the ultraviolet parts of the spectra of the stars, and determined the amount of heat that reaches the earth from some of the fixed stars. In 1864 he first demonstrated the properties of gaseous nebulae (see NEBULA), and in 1868 he experimentally demonstrated the feasibility of using the DOPPLER EFFECT to determine stellar velocities. He wrote *Atlas of Representative Stellar Spectra* (with Lady Huggins, 1900). See SPECTRUM AND SPECTROSCOPY.

**HUGH, or HUGO, OF SAINT VICTOR**, c. 1096-1141, French theologian, philosopher, and mystic, was born in Flanders. He entered the monastery of St. Victor, Paris, about 1115 and in 1131 became teacher of theology and head of the monastic school of the abbey. His scholarship was held in high esteem by his contemporaries and his writings on philosophy and theology exercised great influence upon the religious thought of the 12th-century theologians. His reasoning was based upon the same dialectical method as that used by ABÉLARD, but in contrast to the heterodox teachings of the latter, Hugh's conclusions were in support of orthodoxy. The clash between the two schools of thought gave rise to the SCHOLASTICISM of the 12th century and the retaining of the dialectical method in Catholic theology (which the heresies of Abélard had tended to discredit). According to Hugh there are three degrees of mystical development: (1) *thought*, through which God is revealed in the world of nature; (2) *meditation*, by means of which God is made known within man himself; (3) *contemplation*, which leads directly to a knowledge of God. His writings include *De unione corporis et spiritus*, *De arca Noë mystica* and *De vanitate mundi*, all published in 1648.

**HUGH CAPET**. See CAPET.

**HUGH OF LINCOLN, or HUGH OF AVALON, SAINT,** 1135?-1200, English bishop, born in Avalon, Burgundy. He became a Carthusian, and rose to the rank of procurator general of the order. At the request of Henry II he was appointed prior of Witham Monastery, Somerset (c. 1175), and later became bishop of Lincoln (1186-1200). He was widely known for his charitable deeds and the reforms which he initiated. His principles were of the highest and, although he came into conflict with Richard I over his refusal to pay a land grant, and was later (1194) excommunicated by John, the holiness of his own life was recognized. He was canonized in 1220 and his feast is celebrated November 17.

**HUGHES, CHARLES EVANS,** 1862-1948, American jurist, was born in Glens Falls, N.Y., attended Brown University and Columbia Law School. He was professor of law at Cornell University (1891-93), special lecturer there (1893-95), and at the New York Law School (1893-1900). Becoming a public figure as counsel for the Stevens Gas Commission of the New York legislature (1905), and the Armstrong Insurance Commission (1905-6), he was elected governor of New York for two terms (1907-10). His administration was marked by the creation of the state public service commission, the antirace track gambling law, revision of the state military code, investigation of speculation in stocks, improvement of state banking legislation, and the movement toward establishment of direct primaries in the state.

As associate justice of the U.S. Supreme Court (1910-16), he was known for his carefully prepared opinions. He resigned to become the Republican presidential candidate (1916), was defeated by Wilson by the margin of the California electoral vote, and returned to private practice. He became secretary of state (1921-25) in Harding's and Coolidge's cabinets, concluded more than 50 treaties with foreign nations, re-established friendly relations with South America, and was chairman of the International Conference on the Limitation of Armament (1921). He was a member of the Hague Tribunal (1926-30), and judge on the Permanent Court of International Justice.

In private practice (1916-21, 1925-30), Hughes was a successful corporation lawyer. His clients were public utilities and big companies from which he tried to lift the burdens of taxation and regulation.

As chief justice of the U.S. Supreme Court (1930-41), Hughes speeded up the proceedings of the court and maintained a strict schedule; he opposed President F. D. Roosevelt's plan to revamp the court. See SUPREME COURT OF THE UNITED STATES.

He published the following collections of lectures: *Our Relations to the Nations of the Western Hemisphere* (1929); *Pan American Peace Plans* (1929); *Organization and Methods of the Permanent Court of International Justice* (1930); *The Supreme Court of the United States* (1935).

**HUGHES, DAVID EDWARD,** 1831-1900, American inventor, was born in London. He came to the United States in 1838 and studied at Bardstown College, Kentucky, where he was professor of music and natural philosophy (1850-53). He invented the type-printing telegraph (1855) which he sold to the Commercial Printing Telegraph Company (later absorbed

by the American Telegraph Company). To introduce his system in Europe, he lived abroad after 1857 and secured its extensive adoption. His later inventions include the microphone (1878) and the induction balance (1879). See TELEGRAPHY.

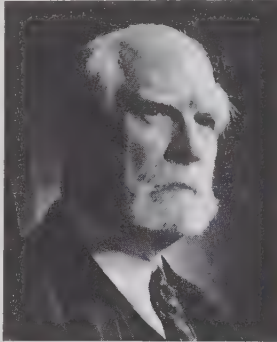
**HUGHES, EDWIN HOLT,** 1866-1950, American bishop and educator, was born in Moundsville, W. Va., and studied at Ohio Wesleyan University (1889) and Boston University theological school (1892). He became a Methodist Episcopal minister in 1892, served as bishop (1908-40), with special duties (1942-44 and 1948). Hughes was president of DePauw University (1903-08) and acting president of Boston (1923) and American (1933) universities. He was a leading spirit in Methodist unification. His writings include: *Bible and Life* (1915); *Christianity and Success* (1928); *Worship in Music* (1929); *William Fraser McDowell: An Appreciation* (1937); *I Was Made a Minister: An Autobiography* (1943).

**HUGHES, HATCHER,** 1881-1945, American playwright, was born in Polkville, N.C. His *Hell-Bent for Heaven* (1924) was awarded the Pulitzer prize for drama. Other works include *A Marriage Made in Heaven* (1918), *Wake Up, Jonathan* (1921, with Elmer Rice), and *The Lord Blesses the Bishop* (1932).

**HUGHES, JOHN JOSEPH,** 1797-1864, American Roman Catholic prelate, was born in Annalaghan, county Tyrone, Ireland. After settling in the United States in 1817, he was educated for the priesthood at the Seminary of Mount St. Mary, Emmitsburg, Md., and was ordained in 1826. He established St. John's Orphan Asylum, while assigned to the diocese of Philadelphia, and also found time to engage in numerous printed controversies with the Protestant clergy, even writing a novelette, *The Conversion and Edifying Death of Andrew Dunn* (1828). In 1838 he was transferred to New York and there he helped establish St. John's College in 1841 (now Fordham University). Appointed bishop of New York in 1842, he became the first archbishop of that diocese eight years later. In 1858 he laid the cornerstone of St. Patrick's Cathedral. A strong defender of Roman Catholicism, Archbishop Hughes held one of the key positions in the American Roman Catholic church due to the 1847-50 Irish immigration. He persistently crusaded for the tenets he believed, fighting with courage against trusteeship in the church, the Irish movement westward, and the Public School Society. Through his insistence on state support of Catholic schools, he was a cause of the passage of the law secularizing the public schools. Failing to win government support, he organized construction of the parochial school system. Archbishop Hughes and Thurlow Weed went to France in 1861 to counteract the influence of the Confederate commissioners there.

**HUGHES, LANGSTON,** 1902-, American Negro writer, was born in Joplin, Mo., and educated at Lincoln University. In his poetry, *The Weary Blues* (1926), *The Dream Keeper* (1932), *Shakespeare in Harlem* (1942), he expressed, often sardonically, the aspirations and frustrations of the Negro in America. Among his other works are the plays, *Mulatto* (1936) and *Troubled Island* (1945); a novel, *Not Without Laughter* (1930); short stories, *The Ways of White Folks* (1934); and an autobiography, *The Big Sea* (1940).

**HUGHES, RUPERT,** 1872-1956, American author and playwright, was born in Lancaster, Mo. He was graduated from Adelbert College, in 1892, and received a master's degree from Yale University in 1899. He was associated with *Godey's Magazine*, *Current Literature*, *Appleton's Magazine*, and *The Criterion*, and was a member of the staff of the Encyclopaedia Britannica Company (1901-5) in London and New York, acting for four years as chief assistant editor of the *Historians History of the World*. He published a comprehensive and remarkably objective biography of George Washington (1926-30) and a large number of popular novels, including *Miss 318*



FROM "FACES OF DESTINY,"  
BY YOUSUF KARSH (ZIFF-DAVIS)

Charles Evans Hughes



(1911), *What Will People Say?* (1914), and *The Man Without a Home* (1935). Among his other publications are the plays *Alexander the Great* (1903) and *Excuse Me* (1911) and several books about music, *American Composers* (1900); *Music Lover's Cyclopaedia* (1903). He was also known as a composer of popular songs and as the writer and director of numerous motion pictures.

**HUGHES, THOMAS**, 1822–96, English writer, was born in Uffington, Berkshire, and was educated at Rugby and at Oriel College, Oxford. The book for which he is remembered, *Tom Brown's School Days*, was published anonymously ("By An Old Boy") in 1857 and was soon accepted as a juvenile classic. A realistic picture of life in the English public schools, the novel was essentially a tribute to the character of THOMAS ARNOLD, who was headmaster at Rugby during Hughes' student days. *Tom Brown at Oxford* (1861) was a relatively unsuccessful sequel.

Although he is now known only as the author of *Tom Brown*, Hughes had a long and active career as a politician and reformer. In 1848 he joined the Christian socialist movement under Maurice and Kingsley and was one of the founders and principals of the Working Men's College, London. From 1865 to 1874 he served in Parliament as a Liberal. An admirer of American democratic ideals, he made several lecture tours of the United States and in 1879 established a shortlived socialistic community at Rugby, Tenn. Among his other writings were: *Religio Laici* (1861); *The Struggle for Kansas* (1862); *The Cause of Freedom. Which is its Champion in America, the North or the South?* (1863); *Alfred the Great* (1869); *Rugby, Tennessee* (1881); *Life and Times of Peter Cooper* (1886); *David Livingstone* (1889).

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**HUGLI**. See **HOOGHLY**.

**HUGO, VICTOR MARIE**, 1802–85, French writer, was born in Besançon. His father rose to the rank of general in the armies of the Revolution and the Empire. He took his family with him to the kingdom of Naples and to Spain, and was made a count by King Joseph: a "castle in Spain" which Victor Hugo took very seriously. Victor's parents were separated, and he was brought up by his mother in Paris. Almost an infant prodigy, he was at 23 one of the official poets of the restored Bourbons, and in that capacity attended the coronation of Charles X at Rheims in 1825. By 1830, he assumed the leadership of the Cénacle, the social circle of the Romanticists, and of the whole school as well, thus leaving behind his glorious elders, Chateaubriand, Lamartine, Vigny. He married at 18, and his union with Adèle Foucher was for many years an ideal one. His liaison with Juliette Drouet, which only death could dissolve, came to be regarded as amorganatic marriage.

The period from 1827 to 1842 was one of incredible activity and triumphs in every field. In poetry, *Odes and Ballads* (1822–26), *The Orientals* (1829), *Autumn Leaves* (1831), *Songs of Twilight* (1835), *Voices of the Innermost* (1837), *Rays and Shadows* (1840). In the drama, *Cromwell*, with a masterly doctrinal preface (1827); *Hernani* (1830), the first performance of which was a hard-fought but brilliant victory for the new school and its young master; *Marion Delorme* (1829–31), *The King's Pleasure* (1832), *Ruy Blas* (1838). In romance, *Notre-Dame de Paris* (1830), a glorious evocation of the medieval city and a defense of Gothic art.

Then Hugo, saddened by the tragic death of his

favorite daughter, discouraged by the failure of his epic drama *The Burgraves* (1843), apparently abandoned literature for politics. For nine years, he published nothing. He became a peer of the realm under Louis Philippe, a moderate Republican deputy after the Revolution of 1848, and at first supported the Prince-President, Louis Napoleon. But when the president seemed committed to reaction, Victor Hugo, whose evolution was steadily toward the left, became a leader of the Radical opposition. He attempted to resist the Coup d'État of Dec. 2, 1851, fled to Brussels, and lived in exile, mostly in Guernsey (Channel Islands) until the end of the Second Empire; he spurned the amnesty tendered by Napoleon III.

This exile opened for Victor Hugo a second and greater career. In poetry, *Châtiments* (1852), a political satire; *Contemplations* (1856), the first part elegiac, the second philosophical; the mighty *Legend of the Centuries* (1859–83), a vast collection of epic myths and episodes, with its weird and powerful prelude *The End of Satan* (1886) and its philosophical conclusion *God* (1891), in its range, power, and beauty, unequaled in modern literature; in sharp contrast, the airy tripping *Songs of Streets and Woods* (1865). In the novel, *Les Misérables* (1862), a great historical fresco and a powerful sermon, in the framework of a popular romance; the minor *Toilers of the Sea* (1866), with fine descriptions and a symbol of evil (the octopus) equal to Melville's *Moby-Dick*; *The Man Who Laughs*, in which his riotous fantasy reached the limits of the baroque and even of the grotesque.

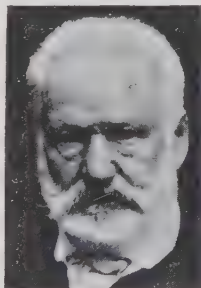
With the fall of the Empire (Sept. 4, 1871), Hugo returned in triumph to Paris; he suffered the hardships of the siege, militant in spirit, although too old to fight. He had not condoned the Commune (1871); but he dared to plead for mercy, and as a result his popularity suffered an eclipse. He gave a passionate poetic chronicle of this crisis in *The Terrible Year* (1872). With the final victory of the Republic in 1876, Hugo became a national figure, the laureate of democracy, the high priest of religious free thought, the apostle of social justice, the patriot who prophetically hailed the United States of Europe. The 50th anniversary of "the battle of Hernani" and his own 80th birthday brought him tributes from all classes and countries.

He kept writing abundantly, *Ninety Three* (1873), a romance of the Revolution, and *The Four Winds of the Spirit* (1881), poems in lyrical, epic, satirical and dramatic form, being the best fruit of that almost juvenile productivity. A lover of children, he was revered as "the universal grandfather" (*The Art of Being a Grandfather*, poems, 1877).

His funeral was a most impressive ceremony. He lay in state under the Arch of Triumph, and the Pantheon was reopened to receive his remains. After this climax, which was partly of a political nature, there was a sharp decline in his fame. He was voted bombastic and shallow, a sonorous word-monger, an apocalyptic Philistine, the idol of the semiliterate. Unfortunately, many admirable works were published during that "depression," and to the present day remain half in shadow. The philosopher Charles Renouvier led a wholesome reaction; he revealed in Hugo the creator of myths, the Seer, strangely primitive in the age of science. The extraordinary perfection and delicacy of his art were first fully enjoyed when the boom of popular applause and the hiss of political opponents had both died away. By the time of his centennial (1902), he was reinstated as one of the major figures in world literature. Baudelaire acknowledged his supremacy; Tennyson aptly called him "weird Titan, cloud-weaver of phantasmal hopes and fears"; André Gide, the very antithesis of Hugo, had to confess: "Our greatest poet, alas!" and in later years, withdrew the "alas!"

ALBERT GUÉRARD, SR.

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CHICAGO HIST. SOC.

Victor Hugo

**HUGO**, city, SE Oklahoma, county seat of Choctaw County; on the Frisco Railroad and U.S. highways 70 and 271, about 50 miles E of Durant and about five miles from the Red River and the Texas border, in an agricultural region. The city was named for Victor Hugo, the favorite author of the wife of the surveyor of the townsite. After considerable real estate speculation, Hugo became a farm market and shopping center. The city has railroad shops, lumber mills, a creosote plant, and factories making peanut products. Pop. (1950) 5,984.

**HUGO OF ST. VICTOR.** See **HUGH OF ST. VICTOR.**

**HUGUENOTS**, the name given the Protestants in France, during the 16th, 17th, and 18th centuries. The Lutheran form of **PROTESTANTISM** entered France about 1520 and soon met with opposition from the Catholics. The work of John Calvin (1509–64) greatly influenced and furthered the cause of French protestantism, which secured adherents chiefly from the middle classes and the nobility. As the Protestant movement gained in strength, opposition to it likewise increased until, toward the end of the reign of Francis I (1494–1547), the Huguenots were being severely persecuted. The Protestants developed their organization as they increased in numbers, holding their first synod in 1559, at which time they adopted a code based on the doctrines of **CALVINISM**.

**Persecutions and Civil Wars.** Persecution of the Huguenots as heretics increased under Henry II, who reigned from 1547 to 1559. The members of the Guise family, which had grown in power during the reign of Francis I, were bitterly opposed to the Huguenots, whose cause was upheld by the powerful and influential Bourbons. Friction between the opposing factions increased until the first civil war broke out in 1562, when the Guises seized the young king, Charles IX (1550–74), and the Huguenots under Prince de Condé and Admiral Coligny took up arms against the Catholics. A series of eight civil wars followed which lasted, with intervals of peace, until the treaty of Vervins (1598) brought the conflicts to an end. During these wars, Catherine de Medici, the Queen-mother and regent for Charles IX, in her efforts to maintain herself in power, sometimes opposed and sometimes favored the cause of the Huguenots, depending upon what she considered at the time to be politically advantageous. On Aug. 24, 1572, thousands of Protestants were killed in the Massacre of St. Bartholomew, but this only served to strengthen the cause of the Huguenots. Henry IV (1553–1610), whom the Protestants had supported for the throne, signed the Edict of NANTES (1598), which guaranteed the Huguenots religious and civil liberty. See **SAINT BARTHOLOMEW MASSACRE**.

**End of the Huguenots.** Following the Edict of Nantes, the Huguenots in France at first enjoyed considerable freedom under Henry IV. But as time went on, the later rulers of France began to realize that the Huguenots stood in the way of absolutism, and persecution of the Protestants steadily increased. Cardinal Richelieu (1585–1642) opposed them, and during the later persecutions of Louis XIV (1638–1715) many thousands of Huguenots fled to other countries in Europe and to the North American colonies. In 1629, the Huguenots came to an end as a political party, although the name persisted. The revocation of the Edict of Nantes in 1685 removed from the Protestants all legal right of defense. Persecutions continued under Louis XV (1710–74), but Louis XVI (1754–93) showed a more tolerant attitude toward the Huguenots. Protestantism suffered greatly during the revolutionary period, after which the Protestants were granted equality and the name Huguenots ceased to be used. W. G. D.

**HUHING.** See **WUHING.**

**HUIA**, a New Zealand bird thought to be extinct. The plumage was greenish black, the tail tipped with white. Remarkable sexual dimorphism was seen in

this bird. The female had a long, curved bill, while that of the male was short and stout. The huia, *Heterolocha acutirostris*, was about the size of a crow.

**HUILA**, department, SW Colombia, a highland region of the Cordillera Oriental; area 7,992 sq. mi.; pop. (1954 est.) 315,690. Although the plains are arid, the chief industries are farming and grazing. The capital is Neiva.

**HUITZILOPOCHTLI**, the war god of the **AZTEC**. He appears before the end of the Toltec dominion as a war god but later he becomes the chief deity of Tenochtitlán (the major Aztec city) and finally of the Aztec as a whole. He remains the great war god but he also assumes the functions and symbols of a sun deity. His temple was shared by Tlaloc, the rain god. His image is described as carved from stone but covered with a paste into which jade, gold, pearls and turquoise were set, while about his waist was a girdle of gold snakes. Offerings to the major gods included the hearts of human beings, and since the war god's favor was necessary his worship was accompanied by the slaying of many captives. FAY-COOPER COLE

**HUKBALAHAP** or **HUKs**, a Communist organization originally formed to combat Japanese occupation of the Philippine Islands in 1942. The name is an abbreviation for Hukbong Bayan Laban sa Hapon, or People's Anti-Japanese Army. The Huks waged guerrilla warfare against the legitimate government of the Philippines and established "Huklandia" in central Luzon. The Huks were strong for several years until Defense Secretary Ramón Magsaysay led a vigorous drive against them in 1952; his success helped him win election to the presidency in 1953. Nevertheless the government had to continue its campaign against the Huk guerrillas in 1954 and 1955.

**HULL, CORDELL**, 1871–1955, American statesman, was born in Overton (now Pickett) County, Tenn. After attending Cumberland University Law School, he was admitted to the bar at the age of 19. He was a member of the Tennessee legislature (1893–97). After Spanish-American War service, he was circuit court judge (1903–07). In Congress (1907–21, 1923–31), Hull became a proponent of tax revisions and low tariffs, and wrote the first Federal income tax law (1913), the revised income tax law (1916), and the Federal inheritance tax law (1916).

Elected U.S. senator (1931), Hull became secretary of state in 1933. As chairman of the American delegations to the Pan-American Conferences of 1933, 1936, 1938, and 1940, Hull implemented the "Good Neighbor" policy. Through the Trade Agreement Act, passed in 1934 to regain the South American market, he worked out many reciprocal trade pacts. Hull called the Havana Meeting (1940), where 21 American republics adopted a co-ordinated plan of Western Hemisphere defense. Prior to World War II, Hull clearly enunciated American opposition to totalitarian aggression. He tried to persuade American airplane manufacturers to stop selling to Japan aircraft to be used over China. He urged a strong rearmament program for the United States, favored all aid short of war to the Allied nations, and in 1939 asked Congress to revise the Neutrality Act to permit the sale of arms to non-aggressor nations; he severely criticized Japan's policy in Asia and was negotiating with Japanese representatives when Pearl Harbor was bombed (1941).



FROM "FACES OF DESTINY," BY  
YOUSUF KARSH (ZIFF-DAVIS)

**Cordell Hull**



## Hull

Hull met with the foreign ministers of Great Britain and Russia (1943) to draw up the Declaration of Moscow, which pledged the Big Four to co-operate until the Axis surrendered, and to establish a general international organization for the maintenance of international peace and security. He resigned because of ill health (1944), but acted as senior adviser to the United States delegation at the United Nations Conference in San Francisco (1945). Hull, known as the "Father of the United Nations," was awarded the Nobel peace prize in 1945, the same year that he won the Theodore Roosevelt Distinguished Service medal. He wrote *Memoirs of Cordell Hull* (1948). See DUMBARTON OAKS CONFERENCE for illustration.

B. F. C.

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**HULL, ISAAC**, 1773–1843, American naval officer, nephew of WILLIAM HULL, was born in Shelton, Conn.; went to sea at 14; and commanded a ship in deep-sea voyages before he was 21. He became lieutenant, U.S. Navy, in 1798, commanded the *Argus* in the war against Tripoli, and distinguished himself during the War of 1812. His fame chiefly rests on his command of the *Constitution* in her successful battle with the *Guerriere*.

**HULL, WILLIAM**, 1753–1825, American soldier, was born in Derby, Conn. He served with distinction throughout the Revolutionary War, taking an active part in the battles of White Plains, Trenton, Princeton, and others. He was governor of Michigan Territory from 1805 until the outbreak of the War of 1812, when, as head of a force of about 2,200, he attempted the invasion of Canada. He actually entered Canada, but he almost immediately withdrew to Detroit, which place he soon surrendered to the British (Aug. 16, 1812) without resistance. He was tried by court-martial, was found guilty of cowardice and neglect of duty, and was condemned to death, but was pardoned by President Madison because of his Revolutionary War record. He was subsequently vindicated in part, on the ground that he was inadequately supported by the War Department. See WAR of 1812.

**HULL**, city, Canada, in SW of Quebec Province, Hull County, on the N bank of the Ottawa River at the foot of Chaudiere Falls, opposite Ottawa, on the Canadian Pacific Railway. Unlimited water power has aided the city's development as a center for the manufacture of wood products. Industries include saw mills, pulp and paper mills, meat packing, and the manufacture of hardware, matches, cement, iron and steel, and mica. Hull was named for the English city, which was the former home of the founders. Pop. (1951) 43,483.

**HULL**, or **Kingston-Upon-Hull**, seaport, and municipal, county, and parliamentary borough, NE England, Yorkshire, in the East Riding, situated at the junction of the Hull with the Humber; 20 miles from the North Sea and 42 miles SE of York. Hull's 13th-century Holy Trinity Church, in Decorated and Perpendicular style, is one of the longest parish churches and the oldest brick church building of England. Other interesting features of the town are: St. Mary's, Lowgate, built in the 14th century; Wilberforce museum and library; the municipal museum; the Ferens art galleries; the Charterhouse hospital, built in 1384; and various institutions for sailors and their families, connected with Trinity Guild, which was founded in 1389.

Hull was founded by Edward I in 1293 as Kings-town-Upon-Hull, and today is an important seaport and one of England's greatest industrial cities. The docks extend along the river front for 10 miles; the oldest, the Queen's Dock, was built in 1775. The town is especially important as a fishing port and for its oilseed crushing and oil-extracting industry. Other leading industries are chemical plants producing drugs, varnish, paints, acetates, disinfectants, tar products, and plant foods; the refining of cod liver oil and alcohol; tanneries; fish canneries; shipbuilding



BRITISH INFORMATION SERV.

**Barges at Docks in Hull**, an important fishing port and industrial center on Hull and Humber rivers

and repair yards; factories building aircraft and marine and aircraft engines; and lumber, flour, and grist mills. There are also manufactures of cocoa butter, soap, starch, leather goods, rope, surgical dressings, cotton and woolen textiles, canisters, electric lighting fixtures and appliances, radiators, milling machinery, iron and steel goods, cement, and cattle food. The chief exports are coal, lumber, cattle food, cured fish, cotton and woolen articles of wearing apparel, and iron and steel wares. Because of its aircraft factories and other war industries and its shipping, Hull was a constant target of German bombers during World War II. Large sections of the city were destroyed, including the Trinity clubhouses, numerous warehouses, and several business blocks along George Street. Pop. (1950 est.) 297,920.

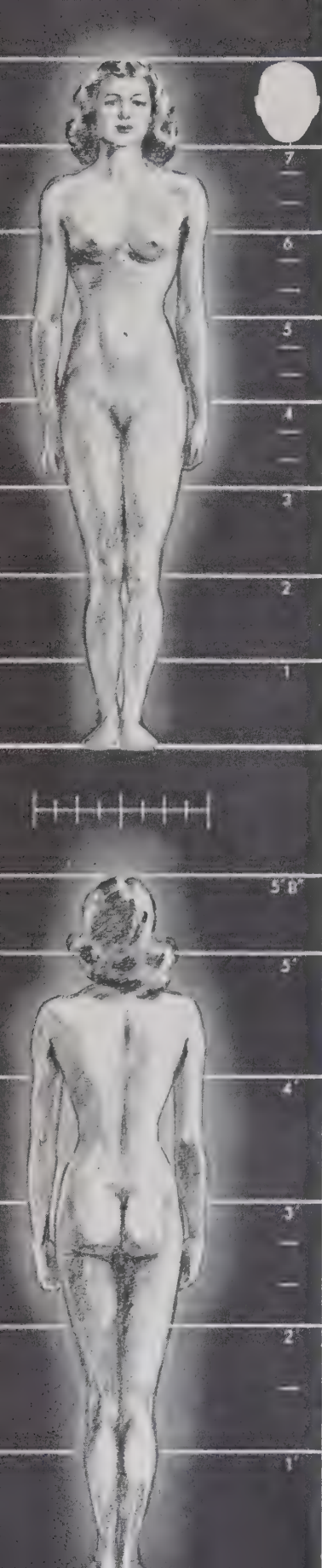
K. E. H.

**HULL-HOUSE**, a famous social settlement in Chicago, Ill. In 1889 the building, which had been erected by Charles Hull, was leased by JANE ADDAMS and Ellen Starr as a home for a social settlement similar to Toynbee Hall, London. In its early days its activities were purely social but they were gradually extended to cover phases of the economic life of the district and it finally came to be identified with the labor movement. Its organization is simple; its residents are volunteers and the ultimate object of its work is to arouse public sentiment to the needs of the city's poorer classes.

Hull-House is best known for its work in the field of social welfare. A group of unusually able people were early attracted to the settlement because of Jane Addams's leadership. These pioneers in the social reform movement published the *Hull-House Maps and Papers* in 1895, which reported the results of their research and observations on the style of Charles Booth's *Life and Labor of the People in London*. The study of Illinois State Institutions by JULIA LATHROP was effective in improving institutional care. Later in 1912 she was appointed the first chief of the Children's Bureau in the U.S. Department of Labor. Both Miss Lathrop and Florence Kelley were active in support of child labor legislation in Illinois and worked for laws to protect women from exploitation in industry. Dr. Alice Hamilton began her study of industrial diseases while a resident. Dr. Rachel Yarros pioneered in the field of social hygiene and maternal and child care. GRACE and EDITH ABBOTT did their early social work under Miss Addams. Hull-House continues to carry on its educational and cultural activities in the spirit of its distinguished founder.

RUSSELL W. BALLARD

**HULUTAO**, seaport, China, Manchuria, in the province of Liaoning, on Liaotung Bay, SW of Mukden. It was developed from a small fishing harbor. Most of the UNRRA supplies sent to northern China in 1946 were shipped through Hulutao.



One head unit  
(1 H.U.)

Chin

Shoulders

Nipples

Breasts

Elbows, waist

Navel

Midpoint

Wrists, crotch

Bottom of knees



H.U. scale laid  
horizontally

Actual height

Maximum width  
= 2 H.U.

Width of waist  
= 1 H.U.

Height of a  
table = 2'4"

Height of a  
chair = 1'6"

## THE HUMAN BODY:

Drawings—for proportions regarded as ideal by commercial artists. Text—for facts about parts of the body and how they function

At rest 3-5 quarts of blood are pumped through the blood vessels every minute—a complete turnover every 30-60 seconds. See CIRCULATION OF THE BLOOD.

During violent exercise a well trained athlete's heart may pump 30-35 quarts of blood per minute—a complete turnover in about 10 seconds.

All exchanges between blood and tissues—delivery of nourishment, removal of wastes, etc.—must be completed in  $\frac{1}{2}$ -1 second. See ARTERIES, VEINS, AND CAPILLARIES.

There are about 250 million red blood cells in one drop of blood. They are so small that they occupy less than half of the volume of the drop. See BLOOD.

When one becomes acclimatized to high altitude, the total number of red blood cells (normally about 35 trillion) may have increased by 60%. See ANOXIA; ACCLIMATIZATION.

The heart beats over 100,000 times every 24 hours, over 2½ billion times in a lifetime of 70 years. See HEART.

The work of the adult heart amounts to about 3,000 ft.-lbs. per hour at rest, may rise to about 15,000 during hard work. See BLOOD PRESSURE.

For any individual, the pulse recorded under basal conditions is regarded as "normal" for him; this normally varies with activity, rest, body temperature, etc. See PULSE.

Skin varies from blond to black depending on the amount of melanin, a black-brown pigment, in the cells of the deeper layers. See SKIN; RACE.

Eye color depends on the amount and arrangement of this same pigment in the cells of the iris. See EYE.

It is possible to live without a STOMACH, but the first third of the INTESTINE is essential. See DIGESTION.

Of the 170 quarts of fluid that filter from the blood into the kidneys every 24 hours, 168-169 quarts are reabsorbed by the kidney tubules, leaving a volume of urine of only 1-2 quarts. See KIDNEY.

There is no "normal" body temperature, 98.6°F. being entirely fictitious. The body temperature fluctuates during every 24 hours, the peak occurring sometime during the day, the lowest point during the night's sleep. See BODY TEMPERATURE; FEVER.

Out of 70,000 ova in human ovaries, only about 400 are matured and liberated or made ready for fertilization after puberty and throughout the reproductive period. See REPRODUCTIVE SYSTEM.

The time when a ripe ovum leaves an ovary can be judged by careful observation of periodic changes in body temperature. See OVULATION; ESTRUS CYCLE.

The number of bones in the adult skeleton varies in different individuals, but most people have 222. See SKELETON.

The sutures between the cranial bones may become obliterated with age in the male but not in the female. See JOINT.

Ossification of all bones occurs earlier in girls than in boys. Girls usually stop growing in height at the age of 18, boys at 20. See GROWTH.

From birth to maturity the body increases in weight 15-20 times, the brain about 3 times, the eye about 4 times.

Between the ages of 4 and 16 years a well nourished boy will gain 65% in height and 170% in weight.

*Ideal proportions conform most nearly to the body type called mesomorphic, or muscular and athletic, but are drawn about one-half head unit taller. (See BODY TYPE.) Artists have found the head unit scale*



It is possible to live without the PITUITARY, THYROID, or sex glands, but not without the PANCREAS, ADRENAL, or PARATHYROID glands. See ENDOCRINE GLANDS.

In 30–60 seconds of strenuous exercise the body may incur an oxygen “debt” that will take over an hour to pay off. See MUSCLE AND MUSCULAR CONTRACTION; METABOLISM.

It is impossible to commit suicide by holding one’s breath, as the stimulus from the respiratory center becomes overpowering. See LUNG.

There is no “normal” respiratory rate. Like the heart rate, it decreases with age, being 30–40 per minute in a newborn baby, 14–18 in an adult.

The human body attains  $\frac{3}{4}$  of its mature weight by the time of puberty, though most other mammals have only  $\frac{1}{4}$  of their mature weight at this stage of development. See MAMMAL; ADOLESCENCE.

About 70% of the body weight is water, 4% (about 7 lbs.) is ash. In an average adult body there are  $2\frac{1}{2}$  lbs. calcium,  $1\frac{1}{4}$  lbs. phosphorus,  $\frac{1}{4}$  lb. sulfur,  $\frac{1}{4}$  lb. common table salt. See PROTOPLASM; CELL.

The estimated 639 muscles in the body account for from  $\frac{2}{5}$  to  $\frac{3}{7}$  of the adult body weight.

Anatomists use the term “belly” to denote the bulging part of a muscle. See ABDOMEN; MUSCLES AND THE MUSCULAR SYSTEM.

The rate of travel of nerve impulses varies from less than 1 to more than 100 yds. per second. Nerve fibers of the greatest diameter conduct impulses fastest. See NERVOUS SYSTEM; SPINAL CORD.

Daytime vision is best in the center of the visual field, nighttime (or low illumination) vision is best in the periphery. See NIGHT BLINDNESS AND NIGHT VISION; EYE.

The range of vibrations that produce audible sound is 20 to 20,000 cycles per second, but hearing is most acute for sounds of 1,000–3,000 cycles. See EAR.

Taste receptors are unequally distributed over the surface of the tongue; a small area in the middle has none at all. See TASTE AND SMELL.

To most people phenyl-thio-carbamate tastes bitter, but to some it is tasteless. Inability to taste this is a Mendelian recessive character. See HEREDITY.

In the skin there are about 3,000,000 pain receptors, 500,000 touch receptors, 200,000 cold receptors, and 30,000 warmth receptors. See SKIN.

The thumb is represented by a larger area in the cerebral cortex than is the thigh. Relative to size the tiny muscles that turn the eyes have the largest cortical representation of all. See BRAIN.

There are about 10 billion nerve cells in the brain. Very few, if any, are added after birth. See NERVOUS SYSTEM.

Men have a higher basal metabolic rate than women. The B.M.R. of a tall thin man is higher than that of a short stout man of the same weight. See BASAL METABOLISM.

All the cells of the body are dependent on oxygen, but the retina is the most sensitive to its lack. A flier pulling out of a power dive suffers a “blackout” before he loses consciousness. See AVIATION MEDICINE.

The sex of a child is determined by the father. Whether a baby will be a boy or a girl depends on whether the sperm cell that fertilizes the egg has an X or a Y chromosome. See SEX; GERM CELLS.

The heart of the embryo begins to pump blood about 25 days after conception. See CONCEPTION; EMBRYOLOGY OF MAN.

One head unit  
(1 H.U.)

Chin

Shoulders

Nipples  
width between  
nipples = 1 H.U.

Elbows, navel

Hips

Midpoint, crotch

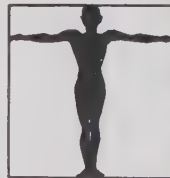
Wrists, buttocks

Bottom of knees



Actual height

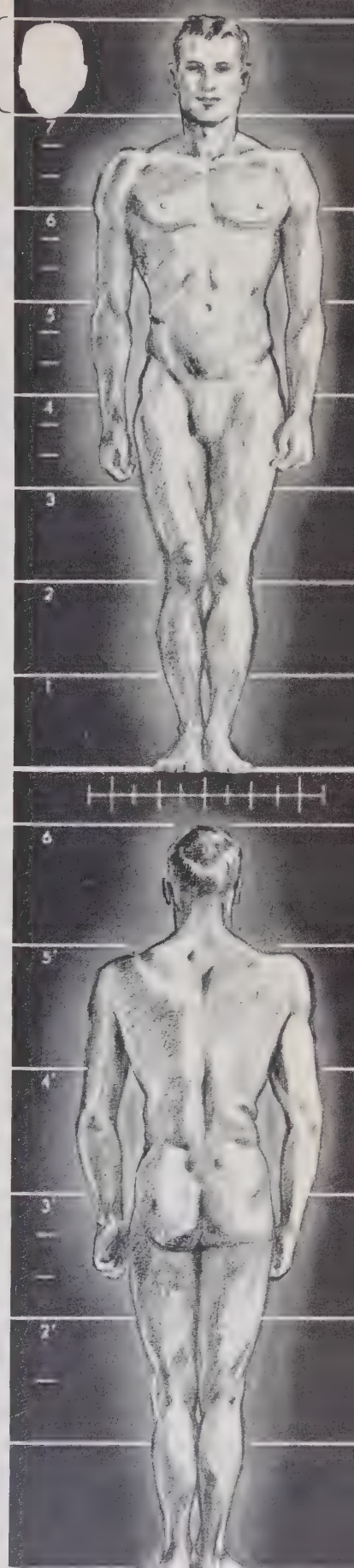
Maximum width  
=  $2\frac{1}{2}$  H.U.



Arm span = height

Height of a  
table = 2'4"

Height of a  
chair = 1'6"



*shown in two upper illustrations, useful in drawing figures of pleasing proportions; use usual measurements (feet, inches, as in lower illustrations) for drawing figures in relation to their surroundings.*

**HUMAN ECOLOGY** is the study of the relation between men and their natural environment. As a phase of sociology it emphasizes integration, or co-ordination of the behavior, culture, and personality, of individuals and groups with environment. The types of human ecology include social, racial, industrial, commercial, and cultural. See **DEMOGRAPHY**; **NATURAL RESOURCES**; **POPULATION**; **SOCIOLOGY**.

A basic characteristic of human ecology is the reciprocal adjustment that is made among people themselves at the same time that they are adjusting to the area they occupy. This adjustment is characteristic of the adaptive behavior in the ecology of plants and animals also, but the complexity is much greater in human ecological processes. (See **ECOLOGY**.) Why people are located where they are at a particular time and what affect that location, in both space and time, has upon their social behavior are concerns of the human ecologist. The nature and development of community structure constitutes the principal focus of his attention. See **CULTURE**, **Culture Areas**; **ENVIRONMENT**, **Cultural Factors**.

**Regionalism.** The growth of population must always be based on the availability of resources that may be used for major requirements of individual and collective survival, as modified by the level of technological development. Any large area, such as the United States or Europe, is composed of different types of economic resources, geographic contours, climatic characteristics, and racial and national groups. Regionalism is a vital part of human ecology. Areas inevitably develop distinctive forms of labor, industry and commerce, densities of population, and qualities of culture. Ecologists speak of the rural South, the commercial East, the industrial North, and the agrarian Middle West. These regions might have become separate political or administrative units to correspond with their distinctiveness had not modern transportation and communication broadened the range of ecological areas. The continuing increase in industrialization and urbanization has become the dominant social fact.

**Distribution of Population.** A major emphasis in human ecology is upon the growth, movement, and distribution of population in relation to a well-balanced society, or the maintenance of ecological equilibrium. Population normally increases or clusters in centers of greatest economic opportunity. Such centers may be industrial and located near adequate supplies of raw materials and power sources; to them population flows in great volume. A natural increase in population is more likely to occur in rural areas, since they are highly favorable to the birth and nurture of human young. The adult population native to rural sections migrates in large numbers to areas of superior industrial and commercial opportunity. Although urban areas have become demographically more self-sufficient because of the mid-twentieth century upturn in birth rate, urban growth is still dependent upon rural-urban migration and rural areas continue to be population-exporting territories. The movement of population from central cities to the suburbs, or the edges of metropolitan areas, is a significant trend toward decentralization. Migration has become international as well as domestic. However, immigration policies continue to provide powerful obstructions to international and intercontinental population redistribution.

**Group Unity.** Ecological organization is based upon a definite unity that groups come to possess during their mutually adaptive processes. Regions are the largest ecological units. Sometimes they are continents, but more often they are subcontinental areas, such as the sectional regions in the United States. They are not political except insofar as political units conform themselves to ecological units, as in the case of Switzerland. Ecologists have shown that conflict and inefficiency often arise because political entities—local, national, and international—so frequently are

set up without regard to the extent of ecological areas. Culture areas—those localities in which forms of conduct, mores, ceremonies, and beliefs are similar because they grow out of a natural coadaptive adjustment to environment—conform more closely to ecological unit areas.

**Ecological Balance.** No considerable area is ever characterized exclusively by a single type of mineral, plant, animal, occupation, industry, or culture. The varied constituent elements of ecological areas contend among themselves for advantage until they achieve co-operation or at least mutual tolerance. A forest composed of a great variety of plants and trees accommodates more living things than one made up of one or a few types of trees. Among human beings the more extensive the division of useful functions becomes, the greater will be the number of individuals who can be supported.

Division of labor is an important ecological process among men. Such division is highly complex and involves social techniques and conscious planning. From this division arise some of the most challenging social and industrial problems of conflict and cooperation. (See **CONFLICT**.) The interdependence associated with the division of labor results in a high degree of differentiation, and a pattern of dominant and subordinate relationships emerges among the many functions that exist and among the rights and privileges pertaining to these functions. When these relationships become stable, they constitute features of ecological balance.

**Ecological Succession.** No balance of ecological organization can remain static in a dynamic area. Disturbing factors constantly enter from the outside, as when immigrants invade a locality; or factors may develop with the area, as when gold is discovered in a rural district, or an invention transforms an industrial region. Such events disturb the ecological balance previously established and set in motion what is known as ecological succession. Such situations have arisen when large waves of immigrants from northern and western Europe have established balanced residential districts in certain areas in the United States. As they became more prosperous, they moved from those areas and immigrants from other groups with lower living standards succeeded them. These in turn moved away and were succeeded by impoverished people, both native and immigrant. Thus an ecological cycle was completed.

Because the relation of man to his physical environment has much to do with community organization or disorganization and thus to over-all stability or instability, the study of ecological areas and processes is a prelude to the understanding of social organization. See **SOCIAL CHANGE**.

HAROLD W. SAUNDERS; L. L. BERNARD

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**HUMANE SOCIETY**, an association dedicated to the protection of children or animals from abuse and cruelty. Humane societies have been established in many parts of the world including Europe, South Africa, and Australia.

**Organization.** The American Humane Association is the national federation of the more than 500 humane organizations in the United States. The association advises and assists established groups, organizes new ones, and speaks for the united humane movement in national affairs. Organized in Cleveland, Ohio, at the first national conference of humane societies in 1877, the association was chartered in 1903 in the District of Columbia. Headquarters were established



in Albany, N.Y., in 1905, and moved to Denver, Colo., in 1954.

**Cruelty to Animals.** The anticruelty movement dates from 1822, when the first legislation for the protection of animals was passed by the English parliament. The Royal Society for the Prevention of Cruelty to Animals was founded in 1824. In April 1866 the American Society for the Prevention of Cruelty to Animals (ASPCA) was granted a state-wide charter by the New York legislature at the suggestion of Henry Bergh, a New York City humanitarian, who served as its first president. (See BERGH, HENRY). Among the largest of the organizations that are outgrowths of the original are SPCA societies in Pennsylvania and Massachusetts and in the cities of San Francisco and Los Angeles; the Animal Rescue League of Boston; the Anti-Cruelty Society and the Illinois Humane Society, both of Chicago; and the humane societies of Missouri, Michigan, and Oregon. All were founded between 1867 and 1870.

**Cruelty to Children.** In 1874 Bergh was instrumental in the establishment of the New York Society for the Prevention of Cruelty to Children, following a much-publicized case in which he took the foster parents of an abused child into court on a charge of "cruelty to an animal." There had been no protection for children against cruelty prior to that time; subsequently societies were formed elsewhere with programs that were investigative, legislative, and educational. See CHILD WELFARE.

**Legislation and Support.** Anticruelty laws to prohibit beating, abusing, and otherwise causing pain and suffering to children and animals were introduced in state legislatures as rapidly as societies were organized. The societies are supported by public and private funds, by contributions, and by income from gifts and bequests.

Some of the anticruelty legislation limited the hours during which livestock in transit could go without food and water, others prohibited cockfights and dogfights and the overloading of work animals. Another law set age limits on the employment of children and, if their employment was allowed, limited the hours. Animal welfare societies campaigned against abuses affecting public health such as the sale of meat from diseased cattle and products from swill milk dairies. Every state in the United-States has laws to punish persons guilty of cruelty to children and animals.

**HUMANISM**, a system of thought or attitude of mind that stresses a practical approach to the study of humanity. Man is essentially a doer, not a thinker, the humanists declared, and knowledge must therefore have as its main object the solving of problems pertaining to humanity. This school of thought developed in the fifteenth century and was born of opposition to scholasticism, the main concern of which, claimed the humanists, was with abstractions, such as God and religion. Further investigation of the Middle Ages since the nineteenth century has shown such distinction generally unacceptable, and humanism has come to be associated with the transition from medieval to modern modes of thought that occurred during the Renaissance. See SCHOLASTICISM; RENAISSANCE.

Renaissance humanism is more specifically applicable to the rediscovery, direct study, and cultivation of the Greek and Roman classics. The humanists extremely stressed the literary excellence of the classics, paying greater attention to their form rather than to their content. Although the concern of humanism tended to the paganistic, it was not openly anti-Christian nor antipapal; but it contributed notably to the later Reformation movement. Such diverse types of men as Boccaccio, Petrarch, Lorenzo Valla, Erasmus, and Sir Thomas More have been called humanists. See REFORMATION; BOCCACCIO, GIOVANNI; PETRARCH; VALLA, LORENZO; ERASMUS, DESIDERIUS; MORE, SIR THOMAS.

**HUMANITARIANISM**, a doctrine or course of action based on concern for the weaker members of human society. Among humanitarians are included a number of otherwise unrelated authors and groups who were mainly motivated by emotional factors—compassion and the feeling of social guilt and responsibility. They were more concerned with relief of actual suffering than with reform of society in general. Nevertheless their ideas greatly influenced the social reform movements of the nineteenth and twentieth centuries.

Humanitarianism was born in western Europe as a late offspring of Christianity and developed against the background of conditions existing in the early stages of industrialization. In the early part of the eighteenth century, in Great Britain, the first attempts were made to arouse sympathy for the individuals who had become victims of the cruel criminal laws then in force. Innumerable offenses were punishable by death, long prison terms, or deportation. The life of convicts in prison was miserable and subject to the whims and cruelties of the gaolers. Deportation to Australia became a frequent punishment in the late nineteenth century and the life of the convict in the deportation ships and the penal colonies was usually one of degradation and misery.

The first person to study these conditions and advocate reforms in an attempt to ameliorate the lot of the sentenced criminal was John Howard (1726–90). He devoted his life to arousing the public and pushing through the English Parliament certain reforms that did away with the worst abuses of this system. Later, Jeremy Bentham (1748–1832) attacked the system from another angle in his *Rationale of Punishments and Rewards*, which first appeared in 1811. Through his efforts statutes were enacted in the British Parliament after 1832 greatly restricting the offenses subject to capital punishment. Sir Samuel Romilly (1757–1818) was closely linked with these reforms. In Charles Dickens' novels is a literary expression of these ideas—in his sympathetic treatment of the convict in *Great Expectations* and in his description of the injustices and cruelty of the judicial process. Through the nineteenth and early twentieth centuries reforms for alleviating the lot of the prison inmate were demanded in the name of humanity and enacted in the United States and western Europe. Reforms of the criminal law reduced further and further the number of crimes requiring capital punishment. The death sentence was completely abolished in some states. France was the last state in western Europe to close its penal colonies—French Guiana—in 1946.

**Child Labor.** The reform endeavors of the humanitarians were also directed toward restriction of the employment of children in industrial establishments and toward provision of proper care and education for them during the formative years of childhood and adolescence. England was the main battleground, for it was there that the Industrial Revolution began. In the early nineteenth century child labor was extensively used in English factories and mines. No laws at first restricted the employment of children, and little care was taken for their education. Overwork in the factories at an early age and complete neglect of the education of employed children were attacked by Robert Owen (1771–1858). Whereas Owen, motivated by philanthropic ideas, was satisfied at the outset to reform conditions in the factories in which he owned a financial interest, he later put forward ideas which made him one of the forerunners of socialism. Socialists like Karl Marx and Friedrich Engels as well as humanitarians continued to attack child labor until legislation of the late nineteenth and the twentieth centuries almost completely abolished its undesirable features. At the same time grew the system of free and compulsory education characteristic of Western civilization. See INDUSTRIAL REVOLUTION; CHILD WELFARE, Child Labor; POVERTY AND POOR RELIEF.

**HUMANITIES**, those studies which throw light on the distinctive characteristics of human life. Such studies are the essence of a liberal education. They reveal the story of human progress, and make the individual free from the limiting ideas and emotions of his own or other times by enabling him to see around them. Today the term humanities is used by many colleges in the United States to designate courses in literature, language, art, philosophy, religion, and history. Thus the humanities are distinguished from social science and natural science.

In the Renaissance, the Seven Liberal Arts were made over into the humanistic studies still admired as polite learning. Latin, Greek, ancient history, philosophy, logic, ethics, and classical literature are regarded as the proper studies for one who is not bound by narrow considerations of the money value and utility of his learning. Through the humanities, it is thought, a capable student will train his intellect and discipline his will while acquiring love of beauty, respect for himself and others, and eager acceptance of truth. The humanities thus develop that humane spirit regarded as characteristic of the cultured person.

R. H. CARPENTER

**HUMAYUN**, 1508–56, ruler of India, son of the famous BABER, and father of the famous AKBAR, ascended the throne of Delhi in 1530. After a 10 years' struggle with the Afghans and Hindus, he was completely defeated in 1540 by Sher Khan Sur at Kanauij. Though retaining the province of Sindh for more than two years, he had eventually to retreat to Kabul. Then after a long and doubtful contest with his three brothers, he again invaded India, and in 1555, with the help of his general Bairam Khan, defeated Sikan-dar Shah, and reoccupied Delhi and Agra; but he died at Delhi from an accident.

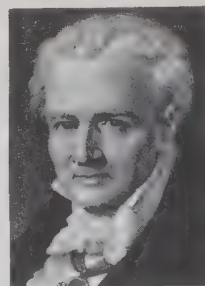
**HUMBER**, ancient **Abus**, estuary on the E coast of England, between Yorkshire and Lincolnshire, flowing from the junction of the Ouse and Trent rivers near Faxfleet, 18 miles E and 19 miles SE into the North Sea at Spurn Head. It is an important commercial waterway, from one mile to eight miles wide, serving Hull, Immingham, and Grimsby, and by canals, south Yorkshire, the Trent, and the Midlands. Although the Humber was considered a possible landing point for the Germans during World War II, invasion was never attempted. However, the chief cities of the area suffered severe bombing attacks.

**HUMBERT I**, 1844–1900, king of Italy, eldest son of VICTOR EMMAUEL II, was born in Turin. On the outbreak of the war between Austria and Italy he took the field and nearly lost his life at Custoza. In 1878 he succeeded his father, and in the same year narrowly escaped assassination at Naples at the hands of a fanatic. His visit to Vienna in 1881 secured for Italy admission to the Triple Alliance, but the failure of the Italian troops in Abyssinia and heavy taxation in later years caused him the loss of some of his popularity. He escaped several attempts on his life but in July, 1900, was mortally shot by an anarchist.

**HUMBERT II**, 1904–, king of Italy for a month in 1946, was born in Racconigi, son of VICTOR EMMAUEL III and Elena. He was educated privately and at the Royal Military Academy in Turin; as crown prince and prince of Piedmont advanced rapidly in the army, and was an inspector general of infantry when World War II began. Mussolini gave him increasingly important commands against the Allies, and promoted him to general (1941), marshal (1942), and lieutenant general of the realm (1944). On the abdication of his father (May, 1946) Humbert became king; but went into exile in Portugal when a plebiscite voted out the monarchy in June, 1946.

**HUMBOLDT, FRIEDRICH HEINRICH ALEXANDER, BARON VON**, 1769–1859, Prussian naturalist and traveler, was born in Berlin. He sailed with Bonpland for the Spanish states of South America in 1799, where they explored the course

of the Orinoco, and proved its connection with the Amazon system, sailed up the Magdalena, crossed over the Andes, and descended on the other side to the sources of the Amazon; then,



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Von Humboldt

after a year spent in Mexico and the United States, the two returned (1804) to Europe. Among other fruits of this journey Humboldt introduced Peruvian guano into Europe, wrote a treatise on plant distribution, formulated laws as to temperature, discoursed on the earth's magnetic force and on volcanoes, and advocated the igneous origin of rocks. In 1808 he settled at Paris, and then for over 20 years was busy digesting and describing the scientific results of his journey. In 1827 he settled in Berlin, and during the next 10 years was occupied with investigations into terrestrial magnetism, though in 1829 he found time for a hurried journey across Siberia. His principal occupation from 1845 down to the time of his death was the composition of the classic *Kosmos*, a summary and exposition of the laws and conditions of the physical universe. Of this there is an English translation (5 vols. 1849–58). The results of his great journey were published in 30 volumes, divided into six separate sections, under the general title, *Voyage aux régions équinoxiales du nouveau continent fait en 1799–1804, par Alexandre de Humboldt et Aimé Bonpland* (abridged Eng. trans., 7 vols. 1814–29).

BIBLIOG.—R. H. Stoddard, *Life, Travels, and Books of Alexander von Humboldt* (1860); V. W. von Hagen, *South America Called Them* (1945).

**HUMBOLDT**, city, NW Tennessee, in Gibson County, on the Louisville and Nashville and the Gulf, Mobile, and Ohio railroads, and U.S. Highway 45; about 17 miles N of Jackson. Humboldt is the trade center of the county situated in the heart of the largest berry and vegetable-growing belt in Tennessee. The chief products are fruit and vegetable baskets, boxes, hampers, shoes, flour, canned goods, and cotton mops. Pop. (1950) 7,426.

**HUMBOLDT GLACIER**, in N Greenland, near Renssalaer Harbor, is one of the largest in the Arctic regions, and stretches N some 50 miles.

**HUMBOLDT MOUNTAINS**, a range in W Nevada, in Pershing County.

**HUMBOLDT RIVER**, Nevada, rises in Elko County and flows in a southwesterly course of 350 miles into Humboldt Sink. The Humboldt is the longest river in the GREAT BASIN. Its waters are used for irrigation. See RECLAMATION.

BIBLIOG.—D. L. Morgan, *Humboldt* (1943).

**HUMBOLDT SINK**, Nevada, in Pershing and Churchill counties, is about 20 miles long and 8 miles wide. At certain seasons of the year its bed is dry and marshy.

**HUMBOLDT STATE COLLEGE**. See COLLEGES.

**HUME, DAVID**, 1711–76, Scottish philosopher and historian, born in Edinburgh. He entered the University of Edinburgh when only 12 years old but left two or three years later without taking any degree. He took up the study of law and later commerce, but abandoned both for the study of philosophy which he pursued in France, mainly at the Jesuit school of La Flèche. In 1747 he became judge advocate to Gen. James Sinclair and in 1752 was appointed the keeper of the Advocates' Library in Edinburgh. He became a member of the British embassy staff in Paris (1765) and served as under secretary of state (1767–68).

Although his *History of England* (1754–62) was received enthusiastically and established his reputation



as a historian, Hume is known especially for his philosophical skepticism which is developed in his writings and became known as *humism*. Hume maintained that it was impossible to attain any ultimate verification of human knowledge since such knowledge was necessarily restricted in scope to that which could be learned through the experiencing of ideas and impressions.

In his first work, *Treatise of Human Nature* (1739, 1740), Hume expounded the basic principles of the empirical school of philosophy, to which belonged such philosophers as FRANCIS BACON and JOHN LOCKE (see EMPIRICISM). In his *Treatise*, Hume is more concerned with attacking the established theories of the nature of substance and reality than he is in building up a system of philosophy. The work is clear and forceful, presenting the fundamental thesis of the author; that knowledge is no more than the cognition of the relationships between various sensory impressions.

His next work was of more general and popular interest: *Essays, Moral and Political* (2 vols. 1741, 1742), which was edited and republished in 1748 under the title *Essays, Moral, Political and Literary*. Next appeared two philosophical works which were really popular abridgments of the *Treatise*: *Inquiry Concerning Human Understanding* (1748), and *Inquiry Concerning the Principles of Morals* (1751). Other works include a volume of essays, *Political Discourses* (1751); *Four Dissertations: the Natural History of Religion; of the Passions; of Tragedy; of the Standard of Taste* (1757) and a posthumous publication, *Dialogues Concerning Natural Religion*.

Being a thoroughgoing skeptic, much of Hume's writing is critical and destructive in character, particularly in his denial of the substantial existence of matter. His positive philosophy is based upon the observation of mental phenomena and the study of the relationship between human experiences as constituting the only source of knowledge and understanding. Hume was a believer in UTILITARIANISM, maintaining that pain and pleasure are the motivations of conduct, and that the ultimate aim of all good actions must be the welfare of mankind. See SCIENCE AND SCIENTIFIC METHOD W. G. D.

BIBLIOG.—C. Maund, *Hume's Theory of Knowledge* (1937); L. F. Kruse, *Hume's Philosophy in His Principal Work: a Treatise of Human Nature, and in His Essays* (1939); N. K. Smith, *The Philosophy of David Hume* (1941).

**HUME, or HOME, Sir PATRICK, 1st EARL OF MARCHMONT and BARON POLWARTH**, 1641–1724, Scottish Covenanter statesman and lord high chancellor of Scotland, was born in Berwickshire. In 1665 he was member of Parliament for Berwickshire, and was imprisoned for his opposition to the government (Lauderdale's policy) in 1675–79. The story of his later concealment in the family vault at Polwarth kirk is well known. For 10 years he lived in exile in Holland, venturing to return with Argyll's ill-fated expedition in 1685, an account of which he wrote (*Marchmont Papers*, vol. III, 1831). At the revolution he joined William of Orange, and in 1693 was appointed an extraordinary lord of session, becoming lord high chancellor in 1696.

**HUMIDIFICATION.** In the practice of air conditioning the control of humidity is as important a consideration as is the control of temperature and air motion. The addition of moisture to air within an enclosed space during the winter months has been practiced for years, and was one of the earliest procedures in the development of modern air conditioning systems.

Dry air may be moistened, or humidified, by causing the air to come in contact with water. When the heat required to evaporate the water is supplied by the air, this usually requires large surface areas of water, a finely divided spray in a spray chamber.

With the spray temperature held constant by means of refrigeration or heating, any desired moisture content of the air may be secured, since an efficient spray

chamber will deliver air practically saturated. In this condition the dry bulb, wet bulb and dew point temperatures match. The air delivered from the spray chamber may then be reheated to any desired dry bulb temperature without disturbing its moisture content.

In some cases a low moisture content is required. This may be obtained by reducing the dew point of the incoming air and removing the excess moisture by (1) bringing the air in contact with calcium chloride (2) passing the air over brine or refrigerated coils, or (3) condensation with a cold spray. See AIR CONDITIONING.

**HUMIDITY**, the state of the atmosphere with relation to the vapor that it contains: it is said to be high when the air is damp, and low when the air is dry. Moisture is everywhere present in the atmosphere, but varies greatly both geographically and locally. No other factor taken by itself exercises so predominant and far-reaching an influence on weather conditions. Temperature and pressure, sunshine and wind, and solar and terrestrial radiation are all subject to marked changes controlled and ordered by the processes of warming and cooling, evaporation and condensation. The air's humidity exercises a strong influence over bodily sensations of heat and cold, and is of importance in breathing, as the quantity of water vapor exhaled with each respiration is much greater when the air is dry than when it is damp. The secretion from the skin is increased when the air is dry; but there is then little perspiration, because it is at once converted into vapor by the dry air, instead of condensing in drops of sweat upon the surface of the body. In a warm, dry air much of the perspiration is unnoticed; while in a hot, humid air it is readily perceived.

An important factor in AIR CONDITIONING is to maintain the ideal relation of temperature to humidity. In artificially heated spaces the air's humidity may be raised to a healthful percentage by air conditioning apparatus by spraying the air with water to moisten it to the desired degree. Absolute humidity is the amount (grains per cubic foot or grams per cubic meter) of vapor actually present in a given quantity of air. Relative humidity is found by writing what a given quantity of air at a given temperature does hold (of water) over what it can hold; this is expressed in a per cent. Saturation (fog or mist) is represented by 100; absolute dryness by zero. The Soviet explorers, Prokofieff, Godunoff, and Birnbaum, at a height of nearly 12 miles, found the air "bone dry" though the methods used would have detected .04 per cent of vapor. At the ocean's surface relative humidity is usually above 90 per cent, but in dry winter weather over land the value may fall below 50 per cent, while in deserts 20 per cent or less is far from uncommon. In the United States the relative humidity varies from a mean annual of 38.7 per cent for the very dry region of Phoenix, Ariz., to 82.9 per cent for Hatteras, N.C. On the summit of mountains a humidity as low as 5 per cent has been recorded during occasional intensely dry spells. Often, however, the atmosphere on the hilltop is in a state of complete saturation. The distribution of vapor with height is very unequal, layers of damp and dry air alternating in the most capricious manner. It appears from balloon observations that only the lowest layer of the atmosphere (33,000 ft.) is concerned in the process of condensation and evaporation. The instrument which measures humidity is the **HYGROMETER**. See **PSYCHROMETRY**.

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**HUMMINGBIRD**, the name applied to any member of a group of small BIRDS that constitute the family *Trochilidae*. They are found only in the Western

Hemisphere and range from the Straits of Magellan as far north as Alaska.

Hummingbirds constitute one of the most brilliantly colored and specialized families of birds. About 488 species are known, and most of these occur near the equator in the Andean region of South America. Northward and southward the abundance of species decreases, so that north of Mexico only about 16 species are known, with only one, the ruby-throated hummingbird, *Archilocus colubris*, ranging east of the Mississippi River.



H. H. HARRISON-N.A.S.  
**Hummingbird**

The greatest variety of hummingbirds in the United States is found in the southwest.

The plumage of hummingbirds is noted for its brilliant iridescent colors and sparkling reflections. As a rule the males are more vivid than the females. The colors are due for the most part to the refraction of light by the finer structural features of the feathers, and hence vary in hue according to the angle at which light strikes the feathers.

The characteristics of the trochilids that distinguish them from their close relatives, the swifts, are the narrow mouth and long bill. Other features, correlated with their habits, are: narrow pointed wings; a well-developed breastbone which provides attachment for the large wing muscles; an extensile, brush-tipped tongue, deeply split into two parts, each of which can be rolled into a tube for sucking nectar from flowers; and small feet and toes that are suited only for perching.

Although hummingbirds are usually small, they vary considerably in size. The largest hummingbird, the giant hummer, *Patagona gigas*, of the Andes, is eight and one-half inches in length. It is strong and powerful and in appearance resembles a large swift. The smallest bird in the world, Helena's hummingbird, *Calypte helenae*, of Cuba, is about two and one-quarter inches long; its nest is only three-quarters of an inch in diameter and the eggs are about a quarter of an inch long. Another remarkable variation among hummingbirds is the structure of the bill. In one species it is nearly five inches long, longer than the rest of the bird; in another species it is a little over a quarter of an inch in length. The bill is usually straight, but in one group it is curved downward until it makes a third of a circle; in others it is turned upward.

Hummingbirds are noted for their fearlessness and pugnacity. They adjust to human beings easily, even entering houses, and quickly learn to take sirup from artificial containers. They are known to attack birds as large as crows, hawks, or eagles if disturbed by these predatory forms. An attack by a female on any intruder usually indicates that the nest is near by.

The flight of hummingbirds is swift. They can fly backwards for a short distance, and as they poise in mid-air their humming wings are visible only as a haze. As a rule the voice is a weak squeak or excited chirping, but several tropical species have well defined songs. Courtship behavior, consisting of specific aerial gyrations, occurs in many species.

Hummingbirds are found abundantly where there are thickets or where there are woodlands interspersed with meadows and openings. Their food consists entirely of insects and flower nectar. As has been mentioned, they will feed on honey and sirup in captivity, but to survive they also need insect material in their diet. Indigestible insect parts are regurgitated in the form of tiny pellets.

The nest is deeply cup-shaped and well built of plant down fastened together with spider webs. It is usually placed saddle fashion on a limb at varying distances from the ground. The outside of the nest is ornamented with lichens or mosses, which make it appear like a natural portion of the limb on which it rests and therefore more difficult to discover. The eggs are invariably two, and pure white. When hatched the young are without feathers and are about the size of bumblebees. At first the bill is short but it grows in length as the bird matures. The young are fed flower nectar and small insects regurgitated by the parent and pumped into the nestlings, the parent's bill being inserted deep into the digestive tract of the nestling.

Hummingbirds are useful species, not only because they destroy harmful insects but because they cross-pollinate many flowers.

A. WOLFSON  
BIBLIOG.—R. Ridgway, *The Hummingbirds*, Report, U.S. Nat'l. Mus. (1890); A. C. Bent, *Life Histories of North American Birds*, U.S. Nat'l. Mus. Bull. 176 (1940).

**HUMOR IN LITERATURE AND ART.** Because the word "humor" acquired its present meaning in England and because some of the greatest humorists have been English, the notion long prevailed, especially on the Continent, that humor is essentially and peculiarly English. Actually, of course, the faculty of sensing the laughable and absurd is a universal trait, and works of humorous intention appear early in the art and literature of all countries. Primitive folk humor, as we find it in prehistoric artifacts, the Fescennine Songs of ancient Italy, and the string drawings of the Eskimo, tends to be savage and sardonic and leans heavily upon sex, violence, and grotesque exaggeration. As a civilization progresses, folk humor may appear in more sophisticated forms but it retains its spontaneity and animality and a characteristic irreverence of conventions and institutions. Whatever criticism of life it may provide is incidental to a bald statement of the incongruous, as in Goldsmith's famous example of the noseless man who was particular about his choice of snuffboxes. This type of the comic spirit is dominant in the plays of ARISTOPHANES; the bawdy jest books of the Middle Ages, such as the *Cento novelle antiche* and the *Cent nouvelles nouvelles*, the ribaldry of RABELAIS; the *sotie* and FARCE of medieval France, forerunners of the COMEDY; the gross drolleries of FALSTAFF and other Elizabethan comic characters; in colonial and frontier literature, such as the Australian "bush ballads," the CROCKETT ALMANACHS, and the works of GEORGE WASHINGTON HARRIS, JOHNSON JONES HOOPER, and THOMAS BANGS THORPE; and in all the fugitive literature of the unalloyed belly laugh from Joe Miller to Chic Sale.

While orthodox criticism has always condemned folk humor because of its penchant for "low" subjects, and while it has succeeded in outlawing much popular literature, it has been forced to accept as masterpieces such works as *LYSISTRATA* and *GARGANTUA AND PANTAGRUEL*, which make no concessions to propriety and in which the animal spirit is rampant. Regardless of their influence upon the humorist's choice of subjects, however, criticism, and civilization in general, have added to the pristine ironic temper a compassion that shades into pathos. This is the humor of CERVANTES, MOLIÈRE, DICKENS, THACKERAY, TWAIN. As a member of the genus SATIRE, depicting the "*contradictions humaines*," such humor occasionally has a sharp edge, but characteristically it is gentle and constructive—a criticism of humanity, but a friendly one.

Humor which has an intellectual, rational appeal rather than an emotional one, is known as wit. Wit provokes laughter by suggesting a connection between ordinarily disassociated ideas. It finds its lowest level of expression in the pun, or simple word play, with THOMAS HOOD as its most incorrigible protagonist; its highest, most purely intellectual stage is the paradox, cultivated with distinction in modern times



by GILBERT KEITH CHESTERTON. BURLESQUE, EPIGRAM, and PARODY may contain elements of pure humor, but primarily they are instruments of wit.

CARICATURE is the generic type of humor in art. In its beginnings it has the same quality as early humor in literature, consisting of grotesque distortion; and, while it advances in refinement with other cultural forms, distortion remains its essential trait. Genre art, however, such as that of DAUMIER and HOGARTH can be at once comic and realistic, since the humor lies in the subject rather than the form. For caricature as an instrument of political satire see CARTOON. See also COMIC STRIP; HUMOR, PSYCHOLOGY OF; LIMERICK.

J. J. M.

**HUMOR, IN PHYSIOLOGY.** In the fourth century B.C., HIPPOCRATES explained human physiology and disease on the basis of what he called the four cardinal humors of the body: *sang* (blood), *phlegm*, *choler* (yellow bile), and *melancholer* (black bile). Blood was said to originate in the heart, phlegm in the brain, yellow bile in the liver, and black bile in the spleen.

This theory was further developed by Galen and by the Arabs. The theory was used to explain various constitutional types of men as well as all diseases. People were supposedly sanguine (hopeful), phlegmatic (sluggish), choleric (angry), or melancholy (sad), according to the humor which predominated. In health, the humors were thought to be normal in quantity and quality, and well mixed. Disease resulted when one humor became dominant over the others. All treatment was directed toward helping the body regain a normal balance of humors through diet, drugs, and surgery.

For 2,000 years the theory of the four humors dominated medical thought. The first devastating attack on the theory was made by PARACELSUS in the 16th century.

**HUMOR, PSYCHOLOGY OF.** Humor is a quality in an object or situation which provokes laughter. It is distinguished from wit in that it is less sharp and intellectual, and more a matter of mood than intelligence. Comedy implies action or dramatic sequence, while humor may lie in an object or in any part of a situation.

The nature of humor has engaged the attention of philosophers from Plato to the present time. Plato recognized the part played by the observer in lending to an object its humorous or laugh-provoking qualities. So did Kant and Schopenhauer and Hobbes.

Humor is a social product. Proof of its social nature is in its changing form from group to group and from time to time in the same group. Like taste in other matters, humor varies with age, sex, personality type, and cultural experience. Differences in what constitutes humor are not based on nationality or race as such but on whatever differences in life experiences may be incidental to race or nationality. Probably all men laugh at something. If one's culture is defined and bounded by his race or nationality, what one laughs at will be what others of one's race or nationality laugh at. However, in a world where people of all races and nationalities live everywhere on the globe, the English boy chuckles at the antics of the "Katzenjammer Kids," the Chinese youngster laughs in glee at "Mickey Mouse," and James Thurber's shapeless humans and lugubrious dog go straight to the "funny spot" of sophisticates everywhere in the world.

Over and above any particular characteristics in different groups, humor has several aspects which are universal. Humorous affairs are always human affairs; no one laughs at a natural object unless, by some accident, it bears the mark of human action. A landscape is not funny. Neither is a sunrise or a mountain. It is a man who laughs, and his hand that makes things laughable.

In the human realm various matters are humorous: odd behavior or dress, such as the antics of a clown

or a ridiculous hat or other costume piece. Although in soberer moments they will admit that it is in bad taste, many people laugh at deformities: bowlegs, "crossed" eyes, lameness, and the like. Extreme forms of vanity, stupidity or humility are subjects for laughter. Incongruities such as Charlie Chaplin's big feet, "Moon Mullins'" prominent eyes, mama's shoes on little Dorothy, are good for a laugh in most groups. Distressing situations short of real tragedy: the man who steps into a puddle, the hat snatched by the wind, the stutterer whose train gets away while he is trying to tell the gateman what he wants are greeted as laughing matters in many groups.

Humor has uses, too, in the affairs of men. Laughing at a common object or situation holds people together in groups because their laughter recognizes common ground between them. Laughter has a protective quality: by presenting certain acts as humorous they are marked as socially undesirable. "Don't be like that; people will laugh at you," is a powerful prophylactic against unwholesome behavior.

Humor may be said to be a powerful force in the world. It points out and emphasizes group values. It holds people together. It provides protection for attack from without and decay from within. It masks coercive and even punitive behavior toward one's fellows. In laughing at another's plight, the subject congratulates himself that he is not in the fellow's shoes. Humor provides a harmless outlet for even cruel impulses, comforts the troubled, reassures the timid, projects the troubles of the harassed man onto his neighbor, gives everyone a weapon against his own fears and frustrations.

FAYE COSSAIRT

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**HUMPERDINCK, ENGELBERT**, 1854–1921, German composer, born in Siegburg. After studying and teaching music in Cologne, Frankfurt, Munich, and elsewhere, he became director of the Meisterschule in Berlin. He ranks with the young Wagnerians and was the teacher of Wagner's son. HÄNSEL UND GRETEL (1893) was Humperdinck's first popular success. Later works are *Die KönigsKinder* (1896), *Die Sieben Geisslein* (1897), *Dornröschen* (1902), *Die Heirat wider Willen* (1905). He also composed incidental music to several of Shakespeare's plays, Aristophanes' *Lysistrata*, and Maeterlinck's *Blue Bird*.



Humperdinck

**HUMPHREY, GEORGE MAGOFFIN**, 1890–, U.S. public official and industrialist, was born in Cheboygan, Mich. He joined the M. A. Hanna Company as general attorney in 1918, became president in 1929, and chairman of the board in May, 1952. In 1946, he was chairman of the Business Advisory Council to the Department of Commerce, and the following year helped negotiate a coal contract with John L. Lewis. In 1948 he headed a committee surveying German industrial plants for the ECA, and his report, which recommended saving 159 plants from reparation, helped reverse Allied policy on West Germany's industry. In November, 1952, Eisenhower named Humphrey Secretary of the Treasury.

**HUMPHREYS, ANDREW ATKINSON**, 1810–1883, American army officer, was born in Philadelphia and studied at West Point. He fought in the Seminole War in Florida (1835–36), and in 1850 had charge of the survey of the Mississippi River Delta. He saw action in many important Civil War battles, Gettysburg among them, and was chief of staff of the



EWING GALLOWAY

### Buildings and grounds of a Christian mission in Hunan province

Army of the Potomac. From 1866 to 1879 he was head of the U.S. Corps of Engineers with the rank of brigadier general. He wrote *From Gettysburg to the Rapidan* (1883) and *The Virginia Campaign of 1864 and 1865* (1885).

**HUMPHREYS, DAVID**, 1752-1818, American soldier, diplomat, and writer, was born in Derby, Conn. He was graduated from Yale in 1771, served in the Revolutionary War as an aide to Gen. Israel Putnam (1778-80) and a colonel to General Washington from 1780 until the close of the war. He was secretary (1784) of the commission, consisting of Jefferson, Adams, and Franklin, appointed by the Continental Congress to negotiate commercial treaties with European governments, and after his return to America (1786), became identified with a group of writers (including Barlow, Dwight, Trumbull, and Hopkins), known as the "Hartford Wits," with whom he collaborated in writing a long satirical poem, *The Anarchiad* (1786-88). He was U.S. minister to Portugal (1791-97), and to Spain (1797-1802). Though he was well known during his lifetime as a satirical poet and essayist, most of his writings have long been forgotten. Among them is an *Essay on the Life of the Honorable Major-General Israel Putnam* (ed. 1818), which is still of some value; *Miscellaneous Works* (ed. 1804).

**HUMPHREYS, WILLIAM JACKSON**, 1862-1949, American physicist and meteorologist, was born at Gap Mills, W.Va., and studied at Washington and Lee and Johns Hopkins universities. He was instructor of physics at the University of Virginia (1897-1905), supervising director, Mt. Weather Observatory (1905-8), and professor of meteorological physics, U.S. Weather Bureau (1905-35). He received the Longstreth medal in 1913 and the Potts medal in 1914. He wrote the comprehensive *Physics of the Air* (1920; ed. 1940) and several popular books: *Rain Making and Other Weather Vagaries* (1926); *Fogs and Clouds* (1926); *Weather Proverbs and Paradoxes* (ed. 1934); *Weather Rambles* (1937); *Ways of the Weather* (1942); *Fogs, Clouds, and Aviation* (1943). EVERETT I. YOWELL

**HUMPTULIP**. A small tribe of Indians belonging to the SALISH or Salishan stock.

**HUMUS**. See SOIL.

**HUN-BARROW**. See BARROW.

**HUNAN**, province, S central China, bounded on the N by Hupeh, E by Kiangsi, S by Kwangsi and Kwangtung, W by Kweichow and Szechwan; area

83,398 sq. mi.; pop. (1947 est.) 28,092,000. The hilly surface of the province is intersected by four great river basins and enclosed on the east, south, and west by mountains rising to 4,000 feet. The largest river is the Siang, which rises in the Nanling Mountains, and flows north into Lake Tungting, draining southeast Hunan. In the northeast the Yuan, a great commercial water route into Kweichow Province, rises on Kweichow Plateau, and flows into Lake Tungting at its southwest extremity. The Lin in the north, and the Tzu in central Hunan also empty into Lake Tungting. The important Hankow-

Canton railway line crosses the province, passing through Changsha, the capital. Other leading cities are Changteh, Hengyang, and Yoyang (Yochow).

An extensive coal field (anthracite and bituminous) stretched across southern Hunan. Iron and antimony are important mineral resources; copper, zinc, mercury, lead, and silver are also found. There are salt and sulfur refineries. Rice and tea are the chief agricultural products, and certain sections are also devoted to growing peas, wheat, kaoliang (sorghum), peanuts, cotton, coffee, and tobacco. Exports are timber, furniture, oil, pottery, paper, and great quantities of tea.

Hunan was the last Chinese province to permit Christian missionary activities. The Japanese occupied most of its eastern and central sections from December, 1941, until the close of World War II in 1945.

K. E. H.

**HUNCHBACK**, or **HUMPBAC**, is a deformity in which there is an abnormal convex curvature of the dorsal portion of the spinal column. It may be the result of poor posture, muscular weakness, or some disease (such as rickets or tuberculosis) that has affected the vertebrae. See SPINAL COLUMN.

**HUNDRED**. The primitive administrative and judicial district in England, generally superseded in later times by the more complex organization of the kingdom into counties, parishes, towns, and boroughs. The judicial administration was in the hands of a hundred-court, composed of the freeholders of the hundred and presided over by the sheriff or, in some cases, by the lord of the manor in which the hundred might be comprised, or his steward. Though the hundreds, which were of Anglo-Saxon origin, have generally disappeared, a few have survived the successive waves of Norman and statutory change and still retain, in part at least, their ancient organization.

The hundred was introduced into the English colonies in America and in the early years was an important unit of local administration, especially in Virginia, Maryland, and Delaware. In Virginia it at first included theoretically 100 families, but later became a territorial unit for judicial, military, and political purposes. In 1634 Virginia was divided into eight shires or counties, and these larger units gradually superseded the hundreds; the terms "hundred" has persisted with certain districts. In Maryland the hundred had much the same function, but there, too,



it finally gave way to the county. In Delaware, however, the hundred has persisted to the present day as a subdivision of the county.

**HUNDRED DAYS, THE**, a name often given to the period between Napoleon's arrival in France on Mar. 1, 1815, after escaping from Elba, until his defeat at Waterloo on June 18 of the same year. See NAPOLEON I.

**HUNDRED YEARS' WAR**, the struggle between France and England from 1337 to 1453, interrupted by intervals of peace. The first period (1337–60) was concerned with the claim of EDWARD III of England to the French throne through his mother Isabella, daughter of Philip IV, as against that of Philip VI of France. This period ended with the peace of Bretigny and included the English victories of Crécy, Poitiers, and Calais. CHARLES V of France renewed the war in 1369, and hostilities continued until the treaty of Troyes (1420). Charles V won back much of the territory lost in the earlier struggle, but HENRY V of England was victorious over Charles VI at Agincourt, and was nominated as his successor to the throne of France. Henry VI, who renewed the war, was defeated by the French through the inspired aid of JOAN OF ARC. By the year 1453 the English were driven from France, and Calais was all that remained to them. See FRANCE, *History*; AGINCOURT, BATTLE OF.



Broken Line indicates route taken by Edward III in 1346 and Henry V in 1415 in invasions of France

**HUNEKER, JAMES GIBBONS**, 1860–1921, American music critic, was born in Philadelphia, Pa. After graduating from a Philadelphia military academy, he studied the piano in Philadelphia and New York and in Paris, where he was a pupil of Georges Mathias. From 1886 to 1898 he was a piano teacher at the New York National Conservatory, and in the

same period began his journalistic career, becoming editor of the *Musical Courier* (1892) and contributing musical and dramatic criticism to the *New York Recorder* and the *Morning Advertiser*. He was music editor of the *New York Sun* (1900–12, 1919–21) and of the *New York Times* (1912–19). As a critic he represented a transition from Victorian genteelness to the iconoclasm of the 1920's, writing with equal gusto and affection of the consecrated past and the complex art of his contemporaries. He was also a provocative commentator on art and literature and a *bon vivant* who combined Rabelaisian appetite with Epicurean discernment. His one novel, *Painted Veils* (1920), was a sensational picture of New York bohemia. A favorite subject was the life and music of Chopin. He produced an authoritative biography of the composer in *Chopin: The Man and His Music* (1900) and wrote the introduction and commentary for the Joseffy edition of Chopin. His critical essays were published as: *Mezzotints in the Modern Music* (1899); *The Melomaniacs* (1902); *Iconoclasts* (1905); *Egoists* (1909); *The Pathos of Distance* (1913); *Ivory, Apes and Peacocks* (1915); *Unicorns* (1917); *Variations* (1921). *Steeplejack* (1920) was his autobiography.

J. J. M.

**HUNGARIAN GRASS**. See MILLET.

**HUNGARIAN LANGUAGE AND LITERATURE**. Hungarian, together with Vogul, Ostiak, Siyeman, Votjak, Lapp, Finnish, Mordvin, and Cseremiss, forms the Ugrian group of languages related to Samoyede, Turkish, Mongolian, and Manchu. Magyar, or Hungarian, has remained pure, with the exception of some Slavic and German accretions. It is an agglutinative language, the root nearly always forming the first syllable of the word, to which affixes are added, prepositions becoming postpositions. Thus the root is not concealed as it usually is in Indo-European languages. Unwritten until the introduction of Western Christianity, the Hungarian alphabet consists of 40 Latin characters. There are 15 vowels (no diphthongs) and eight double consonants. Each symbol has always the same value, and each vowel forms a separate syllable—e.g., *fi-a-im*. The accent falls on the first syllable of a word, and the emphasis on the first word of a phrase. There are many diminutives. A peculiarity is the absence of the auxiliary verb “have,” which is replaced by *van*, “to be,” with the possessive: *Peter has a house* is translated *Peternek van haza* (There is a house of Peter).

**Literature**. A characteristic Hungarian literature first began to develop late in the 18th century. Feudalism and constant wars retarded the growth of a middle class, and members of the upper class, which comprised the majority of literate Hungarians, considered the vernacular unfit for literary expression. Of 4,640 works published in Hungary between 1531 and 1711, only 1,793 were written in Hungarian. During the 18th and most of the 19th century, Latin was the preferred language of educated Hungarians. Debates in the senate were held in Latin, and until 1870 Hungarian magnates often used Latin, Magyar, Slovak, and German in the same sentence when conversing.

A national literature first began to emerge in the last quarter of the 18th century. Latin suffered a blow in 1773, when the Jesuits, the principal teachers of Latin in Hungary were proscribed, and the use of the vernacular was encouraged by the agitators who sprang up after the French Revolution. Periodicals were founded—*Magyar Muzsa* (1787), *Muzeum* (1788)—and various schools, as the Hungarian Guard, the Classical School, and the Magyar School, produced significant authors. Francis Kazinczy (1759–1831), SÁNDOR KISFALUDY (1772–1844), and Daniel Berzsenyi (1776–1826) were famous poets of the period.

The reforms won by the liberal political leaders, Szechenyi and Kossuth, revived the prestige of the Hungarian language and provided an outlet for the abundant literary production of the age. Hungarian

## Hungary

was introduced into the schools (1844), a national theater was established, and numerous reviews and newspapers flourished. Among the most significant writers of the romantic period were the poets Michael Vörösmarty and Sándor Petöfi (see PETÖFI, SÁNDOR ALEXANDER; VÖRÖSMARTY, MICHAEL), the novelists Miklos von Josika (1796–1865) and József Eötvös (1813–71), and the dramatists Ladislás Teleki and Sigismond Czako.

The liberal reforms survived the uprising of 1848–49 and the repressive measures that followed, but the return of Austrian domination induced an intellectual apathy that is reflected in much of the literature of the period. Exceptions were the powerful epics and ballads of János Arany and the novels of Maurus Jókai (see ARANY, JÁNOS; JÓKAI, MAURUS) and Sigismond Kemény (1814–75). Theatrical production is represented by *The Tragedy of Man* (1861) of Imre Madach (1823–64) and the musical folk plays of Ede Szigligeti (1814–78).

**Twentieth Century Literature.** A literary renaissance began in 1900 with the publication of the modernist poems of Endre Ady (1877–1919), which rejuvenated Hungarian poetry, and with the founding of the advance-guard review *Nyugat* (Occident), which initiated a new, cosmopolitan vogue in Hungarian literature. Notable representatives of the “*Nyugat* generation” were the poets Mihály Babits (1883–1941) and Désiré Kosztolányi (1885– ), the novelist Sigismond Moricz (1879– ), and the playwright Ferenc Molnár (see MOLNAR, FERENC).

Following World War I many writers, such as the sensational critic Didier Szabo and the proletarian novelist Louis Kassak, turned again to national themes, but an active minority, including Frederic Karinthy, Aladar Schoepflin, and Désiré Szomory, continued the *Nyugat* tradition of exoticism.

**HUNGARY**, Hungarian *Magyarország*, a republic of central Europe, bounded on the N by Czechoslovakia, on the NE by the Ukrainian Soviet Socialist Republic, on the E and SE by Rumania, on the S by Yugoslavia, and on the W by Austria; area 35,902 sq. mi.; pop. (U.N. 1949 est.) 9,224,000. After 1938 Hungary increased her territory from 35,855 sq. mi. to 66,472 sq. mi. at the expense of Czechoslovakia, Rumania, and Yugoslavia. In 1946 the Allies reduced Hungary's territory to that held by her in 1920, when the Treaty of Trianon went into effect, except for the award to Czechoslovakia of a small area called the “Bratislava Bridgehead.”

**Physical Features.** On the north, east, and southeast, Hungary is encircled by the Carpathians; on the northwest is the Little Alföld (plain) region bordering the Bakony Forest. The characteristic feature of the land, however, is the Great Alföld, (alt. up to 300 ft.) in which half of Hungary lies. Some parts, especially between the Danube and the Tisza (Theiss) rivers, are sandy; others, near Lake Balaton in the west, are marshy. The greater part consists of wide, open, treeless steppes called *pusztas*, where vast herds of horses, cattle, sheep, and swine graze; many acres are excellently adapted for the growing of wheat. The Little Alföld lies partly in Czechoslovakia. The land is rolling and its altitude is somewhat greater than that of the Great Alföld. It has good drainage and rainfall and is very fertile. The best Hungarian vineyards are in the Bakony region. Forests, with beech, oak, and pine predominating, cover about 12 per cent of the country. Forestation has been used successfully in dune areas to fix the sand dunes where the grass cover ordinarily allows the dune to blow in dry seasons.

The Danube, navigable in its entire course through Hungary, follows the Czechoslovak frontier to a short distance above Budapest, where it turns and runs due south to the southern boundary. The Tisza rises in the Carpathians and also follows a general southerly course through the Hungarian plain, joining the Danube farther south. The other rivers of Hungary



EWING GALLOWAY BURTON HOLMES

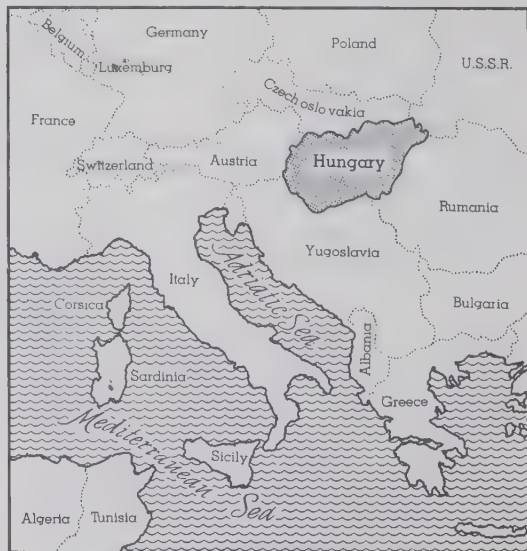
### Budapest, on the banks of the Danube River

are mostly tributary to these two. There are two large lakes—Lake Balaton (265 sq. mi.), the largest lake in central Europe; Neusiedler Lake touches the northwest border of Hungary.

Because of the protection of the Carpathian girdle on the north and east and its open situation toward the south, Hungary enjoys a relatively mild climate. The summers are generally hot, and the mirage is a common feature of the open, sun-baked *pusztas*. There is often a great daily range of temperature, as much as 46° F. between sunrise and noon in summer on the *pusztas*. The rainfall varies greatly in different localities. Generally speaking the precipitation is moderate, and droughts are frequent.

**People.** In 1941, at the height of Hungary's territorial aggrandizement after the temporary acquisitions from Czechoslovakia, Rumania, and Yugoslavia as awards for Hungary's alliance with Nazi Germany, the population of Hungary totaled 14,679,573. Allied agreement in 1946 reduced the area of the land so that the population fell again to its prewar levels. According to the 1941 census, 92.9 per cent of the population was Magyar; 5.1 per cent German, and less than 1 per cent each Slovak, Rumanian, Ruthenian, Croatian, Slovene, and Serbian. See PEOPLES OF THE WORLD.

More than half the population belongs to the Roman and the Greek Catholic churches. Other religious bodies are the Augsburg and Helvetian Evangelicals, the Greek Orientals, Gregorian Armenians, Unitar-



Location map of Hungary





EWING GALLOWAY

Hungarian peasant woman



BLACK STAR

Young and old Hungarians attired in the national costume



EWING GALLOWAY

Hungarian plains cowboy



EWING GALLOWAY

A cattle ranch near Mezokovesd on the great Hungarian plain



BLACK STAR

Budapest capital guard



EWING GALLOWAY

Budapest market place, with Danube River bridge in distance



EWING GALLOWAY

Hungarian gypsy



EWING GALLOWAY

A gypsy street dance, with sod-roofed houses in background



EWING GALLOWAY

### Workmen plow fields on great Hungarian estate

ians, Jews, and Baptists. Religious toleration was a fundamental principle of the state, but after World War II the Communist government waged a campaign of aggression against the churches to destroy their outspoken opposition to Communism. In 1950, under terms of an agreement between the government and bishops of the Roman Catholic Church, all 63 religious orders in Hungary were forbidden. Of the 2,852 monks and 8,956 nuns in the country, only those who taught in the few Catholic schools permitted to remain open remained.

Prior to World War II, the educational system of Hungary was similar to that of Austria. In the school year 1945-46, with leftists in control of the country, a new type of school, the general school, was introduced. All elementary schools, primary schools, and the lower classes of secondary or middle schools were made general schools. Attendance is compulsory for children between the ages of 6 and 14. In 1948, the denominational schools were nationalized; of the 6,669 schools in the country in 1946, 4,322 had been denominational schools. In 1950, eight schools were returned to the church. There were about 500 state colleges and six universities in 1950. The best known universities are the Technical University and the University of Budapest, with about 8,000 students each, and the University for Agronomical Studies. There are also a number of theological colleges, academies of law, and other academies. The total number of university students in 1950 was about 25,000.

### ECONOMIC LIFE

**Agriculture.** Hungary is primarily an agricultural country. About 60 per cent of the land is arable, and over 50 per cent of all employed workers in the country engage in agricultural pursuits. In 1945, the newly elected government introduced land reform, according to which large estates were appropriated for the creation of small holdings. A large portion of the arable land was distributed among individual holders. With the establishment of the Communist regime in 1949 a program of collectivization of agriculture was adopted. The program proceeded slowly because of the resistance of the peasants. They were told to join agricultural co-operatives, which were conceived as a preliminary step toward collectivization.

Cereals are the chief Hungarian crops, wheat alone amounting to 2,400,000 tons annually. The principal growing area is the black earth of the Great Alföld. Tobacco, potatoes, sugar beets, hops, flax, and fruit are also important. Hungary has long been famous for its wines, and these still constitute an important product, though much reduced in quantity. The most famous vineyards are those of Tokay, the Eger district, and the shores of Lake Balaton. The raising of silk worms and of bees is carried on, and horse breeding is profitable. Hungarian horses, famed for speed and endurance, are much in demand. The raising of sheep, swine, and poultry gives employment to many of the inhabitants.

**Mining.** Hungary lost much of its mineral wealth by the terms of the Treaty of Trianon, but extensive iron ore mines remain in the east and north, and coal

## Hungary

and lignite are mined in large quantities, especially in the Pécs area, about 10,000,000 tons annually. Large deposits of bauxite have made Hungary one of the largest producers of that mineral in the world. Salt deposits are an important source of revenue, and there are hundreds of mineral springs throughout the country, and numerous resorts with hot springs. In 1946 oil production totaled about 685,000 tons.

**Industry.** On Jan. 1, 1950, a five-year plan was inaugurated to develop the industries of Hungary. Previously, in 1945, a Soviet-Hungarian trading company was established, with each country supplying half the capital for the development over a five-year period of the oil, aluminum, iron and steel, machine, chemical, transport and shipping, and power industries. In 1946-49, practically all Hungarian industry was nationalized. The food industry is the most important in Hungary, with flour milling in first rank. Other industries include distilling, the manufacture of sugar, hemp and flax, and iron and steel works. Iron and steel are produced in Salgótarján and Miskolc, machinery in Budapest, and cotton and woolen textiles in Budapest, Szeged, Debrecen, Győr, and Pépa. Budapest is also the center of the chemical, leather, and porcelain industries.

**Transportation and Communication.** The total railroad mileage of Hungary in 1939 was 6,307; in 1946 it was 5,416. Of the 1946 total, 1,314 miles were double track. The road mileage in 1946 totaled 18,508 miles of which 2,968 were state, 11,722 miles municipal, and 3,818 miles inferior roads. In 1948 there were 4,570 miles of telegraph and 13,289 miles of telephone lines. The country had 106,768 telephone instruments in 1948. The Hungarian merchant marine in 1948 consisted of 514 vessels.

### ADMINISTRATION

**Government.** The constitution of Hungary as a kingdom dated back to 1000. On Jan. 31, 1946, the National Assembly voted unanimously to declare Hungary a republic; on Feb. 1, 1949, the state was rechristened a "People's Republic," and in August, 1949, a new constitution was adopted. Supreme power is vested in a parliament which consists of 402 deputies. A presidential council of 21 members, elected by parliament, exercises the functions of parliament between sessions of that body. For the purposes of administration, the old Hungarian system of local government was replaced in 1950 by local councils or Soviets. The 58 countries were replaced by subdivisions known as regions, districts, towns, and communes.

**Armed Forces.** The military organization and the armed forces of Hungary were determined by the Allied Control Commission in 1946 which permitted an army of 25,000 men. This arrangement was superseded by the peace treaty of 1947, which authorized an army up to a total of 65,000 men and an air force with a personnel strength of 5,000. The air force strength allowed was 90 aircraft of which 70 may be combat types. There is no navy, but four patrol vessels are maintained on the Danube. At the end of 1948, the Hungarian army was reported to number 50,000 men. A considerable portion of this army was employed to supervise the elaborate frontier control to prevent escape from Hungary. In 1949 armed units under the control of the police took over this task.

### HISTORY

**Founding of Hungary.** Within the Carpathians, between the Danube and the Theiss, were some fifteen nationalities when the MAGYARS, 100,000 strong, appeared (896) under Almus. Attila and his Huns had held the fertile plain in the fifth century A.D., the Gepidae in the fifth and sixth centuries, the Avars in the seventh and eighth, the Slavs in the eighth and ninth. The remnants of these peoples the Magyars drove to the mountainous verge of the



plain, establishing themselves on the Theiss under the sovereignty of Arpád. From 996 to 1301 they were ruled by dukes (4) and kings (21) of the stock of Arpád, son of Almus.

Christianity and monarchy reached Hungary together in the person of STEPHEN, saint and king (1000-1038), from whom Hungary received a constitution combining Roman centralization with German autonomy, each county being governed from a local center, while the country was legislated for in the National Assembly or Diet. In 1222 the Golden Bull, or Magna Charta of Hungary, was signed by ANDREW II (1205-35), as since by each successive sovereign, including the Hapsburgs. This parallel to English history may be further traced in barons' wars, in the struggle of the lower nobility (commons) for parliamentary privileges, in peasant risings, and in dynastic struggles. Hungary, like England and Poland, maintained her central Parliament and limited monarchy, but failed in her struggle with absolutism, the Hapsburgs succeeding where the Stuarts failed.

**The Anjous.** During the reign of BÉLA IV (1235-70) Hungary was devastated by a terrible Mongol invasion. To replace part of the population cruelly massacred by the Asiatic savages, Béla introduced German colonists; hence the German-speaking communities in Hungary to the present day. By the death of Andrew III in 1301 the House of Arpád became extinct, and the throne of Hungary became an object of rivalry between various foreign potentates. After many vicissitudes, Hungary was fortunate enough to find a worthy king in the person of Charles Robert of Anjou (1308-42), who did much to place his adopted country on a level with more civilized western nations.

From the Arpád dynasty to the Hapsburgs eleven kings ruled, Louis I of Anjou (1342-82) being the most formidable continental European monarch of his time. Then followed the struggle with the Ottoman invasion, in which JÁNOS HUNYADI, regent (1446-52) under Ladislaus, defeated the sultan before Sofia (1443), made a peace for 10 years (1444), and successfully defended Belgrade (1456). His son Mathias, elected king in his boyhood, founded the Black Legion, the Hussars, the University of Buda; conquered Vienna (1485) and held it till his death (1490). Under Vladislaus (1490-1516) Hungary was the scene of a sanguinary peasant insurrection, known as the Dózsa revolt, which was ultimately suppressed, and led to a system of abject serfdom. Louis II's reign (1516-26) was still more disastrous. In 1526 the Turks, under Solymán the Great, annihilated the Hungarian forces at Mohács, pillaged whole districts, and carried off some 30,000 Hungarians as slaves. Louis II himself lost his life in or after the battle of Mohács, and the Hungarian throne became once more the prize of contention between two claimants. Eventually the Hapsburgs, represented by Ferdinand of Austria, obtained the throne.

**The Hapsburgs.** Hungary was now (1538) partitioned, Austria being supreme in the west, Turkey in the south and center, while Transylvania remained

the rallying-point of Magyar life and nationality. For some 150 years the Turks were masters in two-thirds of the Hungarian counties, from which they were driven (1683) by John Sobieski, king of Poland, and Leopold of Austria. But Hungary had only changed masters, and was never lower than after the peace of Karlowitz (1699). See JOHN III, SOBIESKI.

Leopold died in 1705 amid the anxieties entailed upon him by another Hungarian rising, led by a second Francis Rákóczy, which did not end before 1711. Leopold succeeded in causing the diet to declare the throne hereditary in the House of Hapsburg, and Charles VI (1711-40) received their adhesion to the Pragmatic Sanction, securing the right of succession in the female line. Nevertheless, his daughter MARIA THERESA's claim to the throne was called in question by several German rulers and by France, her dominions were invaded, and she saved them and herself only through the magnanimous self-sacrifice of the Hungarians. Her son and successor, JOSEPH II (1780-90), provoked an outburst of national spirit by his attempt to make Hungary part of a vast pan-Germanic bureaucracy, and on his deathbed he saw himself compelled to recall all his illegal edicts, with the exception of one, viz., that enjoining religious toleration. He was succeeded by Leopold II (1790-92), and he by Francis I (1792-1835). As long as the Napoleonic wars lasted, the Hungarians supplied money and troops to the Austrian army and took their share in combating the French Republic and empire.

**Kossuth.** The policy of Metternich and the whole court party drove the Hungarians into political revolt, which culminated in an armed rebellion in 1848. Under KOSSUTH the Austrians were driven out of Hungary, but owing to the intervention of Russia, the Magyars surrendered at Világos in 1849, and Hungary was incorporated into and governed as an hereditary province of Austria. While the country displayed no active resistance, all the efforts of the centralizing and Germanizing system so completely failed that by 1857 the Vienna government began to see its futility and to offer some concessions.

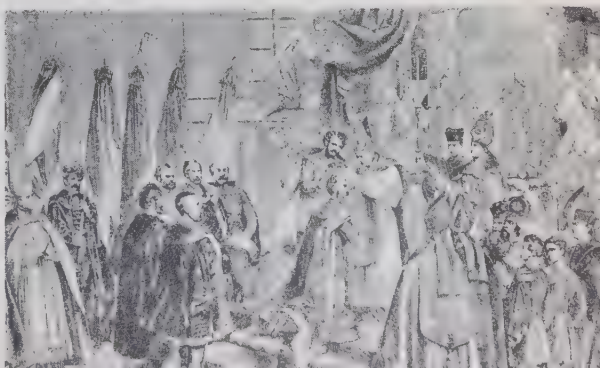
**Francis Joseph.** After the disastrous Italian war in 1859 the old Hungarian chancery, as it existed previous to 1848, was re-established, but failed to satisfy the Hungarians, whose passive resistance threatened with a final breakdown the Austrian state machinery. At length in 1861 the diet was once more convoked; but, as it demanded the full restitution of the constitution of 1848, it was quickly dissolved. Gradually, however, better counsels prevailed at the court of Vienna. Parliament was again summoned in 1865, and the demands of the Hungarians, as formulated by Deák and his party, were complied with. FRANCIS JOSEPH was crowned king of Hungary, June 7, 1867, and entered on the faithful discharge of his duties as constitutional monarch.

Hungary made good use of the period of internal peace enjoyed after the coronation, and made rapid strides in the path of civilization. It established an admirable system of elementary and higher education,

**Surrender of the Magyars at Világos in 1849**



**The coronation of Francis Joseph in 1867**



built a magnificent net of railroads, improved its judicature, and greatly developed commerce and industry. In 1896 a thousand years of national existence was celebrated by a millennial exhibition at Budapest.

In political affairs the principal developments were the growth of the nationalist spirit, evidenced by a growing demand for the differentiation of the Hungarian from the Austrian army, for an independent customs territory, and for a state bank. The struggle between the Catholic and Protestant parties occupied an important place in internal politics, and civil marriage, religious independence and Jewish toleration were burning questions. Cabinet crises were frequent between 1905 and 1910, and the severance of the Dual Monarchy was more than once threatened.

**World War I.** The outbreak of the Great War in 1914 seemed for a time at least to unite Austria and Hungary, but as hostilities progressed the various subject races became increasingly restless, and affairs were more and more disturbed. Francis Joseph died on Nov. 21, 1916, and in May, 1917, Count Tisza, prime minister since 1913, resigned because of a disagreement with the franchise reform policy of the new king, Charles IV. A new ministry was thereupon formed by Count Julius Andrássy, an Advanced Liberal, but in less than a month, before it could carry out the proposed reforms, it was succeeded by a coalition cabinet headed by Count Moritz Esterházy. The Esterházy ministry resigned in August, 1917, and Dr. Alexander Wekerle became premier (August 29, 1917). Having twice reorganized his cabinet, he remained in office until October 25, 1918, when he was forced to retire and was succeeded in the premiership by Count Albert Apponyi.

In the meantime the Hungarian Parliament had adopted a resolution declaring Hungary's independence of Austria, to which it was henceforth to be united only by the personal element of the crown (Oct. 17, 1918). On Oct. 29 announcement was made of the king's intention to establish Hungarian independence, but as a step to save the dynasty this came too late, and the king was forced to abdicate (Nov. 3).

Count MICHAEL KÁROLYI, who had been named premier on Oct. 31, assumed control, and the Hungarian People's Republic was formally proclaimed Nov. 16, 1918. A second revolution, more radical than the first, occurred in March, 1919. This was attributed to several factors—dissatisfaction with the armistice terms, particularly the boundary provisions; the allied proposal of military occupation; and the growing influence of BOLSHIEVISM, combined with the serious economic condition of the country. An outbreak in February was crushed by Károlyi, but the situation soon became so serious that on March 22 he surrendered the government to the extremists led by BÉLA KUN, a radical of the Russian Bolshevik type. The Peace Conference issued an appeal to the Hungarian people. This together with the growing opposition to the radical measures of the Kun government and the serious food situation led to the downfall of the Kun regime. Kun resigned on August 1, 1919 and a new government headed by Julius Peidel, and including several members of the Communist regime, was established. A week later Archduke Joseph assumed control of affairs and took the title, Governor of the State. He called for the suppression of bolshevism and the establishment of a national assembly. His government, however, was not recognized by the Peace Conference, and on August 22 Archduke Joseph announced his withdrawal. A few weeks later Karl Huszár formed a new cabinet, pending the meeting of the National Assembly.

The Treaty of Trianon established peace and officially broke up the Dual Monarchy which lasted for almost 50 years. One of the principles of the victorious Allies was that of self-determination. Many of President Wilson's Fourteen Points were concerned with the redrawing of boundary lines so that

minority people could live under their own government. The Austro-Hungarian monarchy, which contained many minority peoples, was destroyed and a separate Austria and Hungary came into existence. Hungary was reduced from a state of 18,000,000 inhabitants to a country of about 8,000,000. The majority of people lost were not Hungarians. But of the 10,000,000 people taken away from Hungary, about 3,000,000 were Hungarians. These Hungarians were made to live in Rumania, Czechoslovakia, and Yugoslavia, and created a new minority problem. According to the Hungarian census there were 3,000,000 Hungarians living in neighboring nations. The Czechoslovak, Rumanian, and Yugoslav census put this figure around 2,500,000. By the TREATY OF TRIANON, Hungary lost more than two-thirds of her former territory. In spite of the opposition of monarchist and nationalist elements, the Treaty was signed on June 14, 1920.

**The Rise of Horthy.** The National Assembly, meeting early in 1920, entrusted the government to Admiral HORTHY as regent and head of the state. On March 23 he proclaimed Hungary as a monarchy, with the throne vacant. Under this new leader, formerly an admiral in the Austro-Hungarian navy and later head of the army created to fight the Bolshevik government, a dictatorship was instituted. The White Terror succeeded the earlier Red Terror of the Bolshevik government.

On March 27, 1921, King CHARLES returned to Hungary and called on Horthy to give up the regentship. But the National Assembly voted against the restoration of the Hapsburg king. The hostility of the Little Entente—Czechoslovakia, Yugoslavia and Rumania—also contributed to King Charles' withdrawal to Switzerland. A government crisis ensued, and Count Stephen Bethlen became the head of the new cabinet. On October 21, King Charles made his second attempt at a Hapsburg restoration. He arrived at Ödenburg and leading his troops he marched on Budapest. Czechoslovakia and Yugoslavia mobilized and the anti-Karlist forces in Hungary defeated Charles' troops and took him prisoner. He was exiled to Madeira and the Dethronement Act of November 4, 1921, deprived Charles of his hereditary rights to the Hungarian throne. In subsequent decades Hungary was a kingdom without a king and was ruled by an admiral without a navy.

**Foreign Relations.** On December 12, 1921, Hungary signed a separate peace treaty with the United States. Next year Hungary was admitted to the League of Nations. In 1923 the League of Nations adopted a plan for the economic reconstruction of Hungary. Hungarian foreign policy after World War I was dominated by the desire to achieve the revision of the Treaty of Trianon. The demand that the lands belonging to the Holy Crown should be returned found expression in the motto "No; No; Never!" of the revisionists who refused to be reconciled to the *status quo*. Subsequent to 1920, Hungary's relations with the Little Entente were strained. The Little Entente was partly created to frustrate Hungarian revisionism. Since Hungary insisted on revision and the right to rearm, co-operation between Hungary and Czechoslovakia, Rumania and Yugoslavia became difficult.

**Consolidation of Horthy's Regime.** The elections in 1922, which were not free, gave Bethlen's government a large majority. Bethlen's policies aimed to preserve the *status quo* in the economic and social life of Hungary. On October 4, 1932, Julius Gömbös became the prime minister. He was above all an ardent nationalist and revisionist and sought to obtain the co-operation of Italy to realize the territorial claims of Hungary. Next year a law was passed empowering Horthy to prorogue or dissolve the parliament without any checks on his right to do so. Subsequently, another law was passed which released Horthy from all responsibility to the parliament.





Budapest freedom fighters rally, in October 1956

**Co-operation with Italy.** In July, 1933, Gömbös visited Mussolini and next year on March 17 the Rome Protocols were signed, establishing close political and economic relations between Italy, Hungary and Austria and forming an opposition to the Little Entente. On October 6, 1935, Premier Gömbös died and was succeeded by Koloman Darányi. In the following two years Italy drew closer to Germany and Yugoslavia and lost some interest in the revisionistic claims of Hungary.

**Relations with Nazi Germany.** Already in 1933 Hungarian government established close relations with Nazi Germany. But paradoxically it was pro-Nazi abroad and anti-Nazi at home. Ever since 1933 the Hungarian Nazi movement had been growing. The main support of the Hungarian Nazi party, headed by Major Szálasi, came from the impoverished lower middle class, and to a lesser extent from the landless peasant. The propaganda of the party was based on three major objectives: anti-Semitism, recovery of lost territories, and the redistribution of the land. The government twice arrested Szálasi, in March, 1937, and in February, 1938. On May 13, 1938, Béla Imrédy formed a new cabinet and instituted some economic and political reforms as well as anti-Semitic measures. In the summer Horthy paid a visit to Germany and was cordially received. When Czechoslovakia was dismembered by Germany, Hungary received southern Slovakia. In March, 1939, Hungary occupied Carpatho-Ukraine. During this time Imrédy resigned and Count Paul Teleki became premier. At the elections of May, 1939, the Nazi party became the second largest party.

**World War II.** On June 27, Hungary declared war on Russia and subsequently broke diplomatic relations with the United States. Hungarian soldiers were a part of the Nazi army which penetrated deeply into Russia in 1942. In 1944 Hungary was occupied by Germany and several puppet governments were set up. When the Russian army approached the capital, Horthy asked for an armistice. But Nazi sympathizers seized the government and Ferenc Szálasi became premier. In December a provisional government was formed in the Russian occupied part of Hungary. On January 20, 1945, this government signed an armistice with Soviet Russia.

**Postwar Hungary.** The war damaged the industries and transportation system but in most cases did not destroy them. A great many people became impoverished by the war and the subsequent inflation. To deal with the inflation the government introduced a new currency which came into existence on August 1, 1946. The reparations further aggravated the economic and financial position of Hungary. Basic changes occurred in the economic and political structure of the nation. Extensive land reform was carried out and the aristocracy was abolished. On January 31, Hungary became a republic. Three new

## Hunger

parties came into existence. The Smallholders party had wide popular support, the Social Democratic party was second, and the Communist party was small but influential. A Communist coup in May, 1947, drove Prime Minister Ferenc Nagy from office. In the national elections in August, 1947, the Communists emerged as the strongest single party and by February, 1949, Hungary was under Communist domination. The conflict between the government and the Roman Catholic church evolved in the trial and imprisonment of József Cardinal Mindszenty in 1949 (see MINDSZENTY, JÓZSEF). Several government officials, including Laszlo Rajk, former Communist minister of the interior, were charged with plotting to overthrow the government and sentenced to death. In 1950 an American businessman, Robert Vogeler, was charged with spying and imprisoned for a year. Totalitarian measures caused discontent that resulted in the ousting of Premier Mátyás Rákosi in 1953. Imre Nagy, who adopted a more moderate policy, replaced Rákosi, but two years later Rákosi returned to power with Andras Hegedüs as puppet premier. In October, 1956, oppressive measures of the government of Erno Gerö, who has succeeded Hegedüs, provoked a general uprising. Gerö resigned and Imre Nagy formed a new government with the participation of the non-Communists. Budapest was conquered by Soviet troops and a new Communist puppet regime, headed by Janos Kadar, was installed. Cardinal Mindszenty, released from prison by the rebels, found refuge in the U.S. embassy.

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**HUNGER AND APPETITE.** Hunger should not be confused with appetite, although in popular parlance the two terms are often used interchangeably. *Hunger* is the sensation of craving or wanting food, or the associated feelings of weakness, uneasiness, or pain in the stomach. Hunger can be prevented or abolished by food intake.

*Appetite* is an acquired pleasant anticipation of eating based on the memory of the odor, taste, and appearance of foods. Appetite may be present after hunger has been appeased.

**Theories of Hunger.** Hunger is regarded as a natural reaction of the organism to ensure the eating of foods adequate for the maintenance of health. But why we feel hungry when we do and what factors regulate this feeling cannot yet be answered in full. The *local or peripheral theory of hunger* received important support from the observations of Boldyrev (1905), who first employed the "balloon method" of recording gastric motility (see **STOMACH**). He found that in dogs deprived of food for several days the stomach shows periodic contractions that are much more powerful than those occurring during digestion. Cannon and Washburn (1911) applied the balloon technique to man and proved that the contractions of the empty stomach coincide with periods of hunger pangs. From 1912 on Carlson extended this method to analyze in detail the many types of stomach motility, the periods of their incidence in animals and in man, and the conditions that influence hunger. See CANNON, WALTER B.; CARLSON, ANTON J.

Newborn or even prematurely-born infants manifest full-fledged hunger contractions of the stomach that are, if anything, more powerful and certainly more frequent than those of adults. Infants at first live according to a "gastric cycle," waking up and crying for food every 2½ to 3½ hours. The first evidence of learning ability in the infant is the giving

up of the 2:00 A.M. feeding call at the age of a few weeks. This is later extended to an unbroken night's sleep and the concentration of all feeding periods to fit the usual waking hours of adults. Thus, one can be educated very early to disregard the hunger contractions during sleep.

Among the means of decreasing or suppressing hunger sensations, one should mention, aside from the proverbial tightening of the belt (which works), tasting and chewing of food, as well as smoking. A low level of blood sugar experimentally induced by INSULIN leads to an increase in the intensity of hunger. Intravenous injection of sugar (to restore the blood sugar level) decreases the insulin-induced overactivity of the stomach—but only when the pathways from the central nervous system to the stomach are intact. This suggests that a nervous component is one of the factors normally involved in regulating hunger motility of the stomach. However, intravenous injection of sugar will not abolish naturally occurring hunger contractions; these are depressed when sugar that has been eaten enters the intestine. How this is accomplished is not known, but there is a possibility that the stomach is affected via the blood stream by a hormone liberated from the intestinal wall when sugar is absorbed.

The *general or central theory of hunger* finds its support not only from the above mentioned nervous and hormonal influences, but also from the established fact that surgical removal of the stomach, in man or in animals, does not abolish the periodic craving for food. It is true that, deprived of the storage function of the stomach, such persons or animals have a more limited capacity for food intake, but they eat more often, and the total amount of food eaten per day remains unchanged. Furthermore, as will be shown below, there exist specific hungers for certain constituents of the diet, in addition to a craving for food in general. However explained, these point to "extra-gastric" factors, rather than to a mere increase in stomach contractions, as causative agents.

**Appesement and Satiety.** Irrespective of the single or multiple nature of its origin, hunger is unpleasant or even painful, and its appeasement or satisfaction is, if only by contrast, pleasurable. Here again there may be more than one factor, the local or general aspects differing with the species of animal and its diet. The dog, for instance, is an animal that eats large amounts of food at a time and can be easily adapted to infrequent feeding. If a dog's esophagus (gullet) is surgically cut and the two openings brought to the surface of the neck and allowed to heal, the animal is in a condition for performing the "sham feeding" test. When provided with a panful of raw meat cut in convenient chunks, such a dog will proceed to swallow the meat without chewing. But the meat, as it slides down the esophagus, drops out into the pan through the upper artificial opening or fistula. Sham-fed dogs have been known to continue to eat—apparently with a great deal of pleasure—for many hours. Evidently the act of eating in this case does not satisfy hunger. But if while the dog is eating, pieces of meat are passed into the stomach through the lower esophageal fistula, further food intake is stopped when the stomach is filled.

The rabbit normally nibbles continuously, spreading its food intake over many hours. The mechanism that cuts short the carnivorous dog's feeding does not operate in the herbivorous rabbit. By the nature of things, plant materials are continuously available, while animals as food must be hunted and are therefore a more uncertain source of supply. This undoubtedly explains why carnivorous animals tend to gorge themselves when food is available in abundance.

The capacity of the stomach can be greatly increased by relaxation of its muscular walls. However, there is a limit to the amount of food that can be swallowed before the relaxed stomach begins to be distended; such a stretching of the stomach produces

considerable discomfort, which increases with each swallow. In contrast to satisfaction, this state, referred to as satiety, can be very unpleasant and compels even gluttons to stop eating in the presence of an overabundance of attractive food.

**Anticipated Hunger.** Experience with unappeased hunger leads some animals, particularly rodents, to hoard food for future consumption. Even when raised in the laboratory, with food always available in abundance, rats show a slight tendency to stow away food. Repeated starving for 24 hours leads to a tremendous development of this hoarding instinct. Earlier experience influences development of this hoarding activity. Repeated starving for 24 hours will produce greater hoarding activity in adult rats if as infants they were subjected immediately after weaning to repeated deprivation of food; as adults such rats will hoard more food than "control" rats. If pellets of food are placed outside the rat's cage, just beyond its reach, during the repeated starvation, such a rat will also hoard more than "control" rats. Similarly, the tendency of human beings to accumulate worldly goods beyond their ability to consume them may often be traced to such early deprivations or later frustrations.

**Influence of Appetite.** Well-fed persons, rarely ravenously hungry, often require an appetizer, or *apéritif*, to "open up" their latent appetite. COCKTAILS and other alcohol containing beverages, often taken before meals, are popularly believed to increase hunger. Actually, alcohol decreases hunger contractions, but may increase appetite by its quick depressing action on the brain, thus removing anxiety and other unpleasant feelings that may interfere with the full enjoyment of the meal. Likewise, "bitters" taken before eating may stimulate appetite by making subsequently eaten food taste better by contrast.

**Appetite Levels** have been defined as the amounts of the various natural foods people would like to consume, if these foods were available in unlimited quantities at all times. A recent survey made in New England revealed that some foods, although rated low with respect to certain vitamins or minerals by nutrition experts, may be excellent sources of these dietary factors on the basis of consumer preference. For instance, in thiamine content whole milk is rated eighth from the bottom in a list of 61 foods, but a pint of milk per day becomes an important purveyor of this vitamin. The following tabulation shows how some familiar foods were rated:

| Highest Preference | Least Preferred |
|--------------------|-----------------|
| Beefsteak          | Frankfurters    |
| Pork chops         | Codfish         |
| Turkey             | Sardines        |
| Bacon              | Oysters         |
| Butter             | Cottage cheese  |
| Tomatoes           | Baked beans     |
| Carrots            | Sauerkraut      |
| Cabbage            | Succotash       |
| Green corn         | Summer squash   |
| Sugar              | Parsnips        |
| Chocolate          | Tapioca         |
| Ice cream          | Oatmeal         |
| Devil's food cake  | Peanut butter   |
| Oranges            | Doughnuts       |
| Pineapple          |                 |
| Strawberries       |                 |
| Nuts               |                 |

In a special class were "problem foods." These might have rated high but for the fact that the majority of those interviewed had never even tried them. Beef brains, kidney, goat milk, whey, clams, soybeans, and mangoes were in this group.

The caloric value of the quantities of foods with a high preference rating that people would like to consume is two or three times the requirement of the organism. It is significant, however, that even if calorically reduced to a "normal" level, a diet made up of such foods would furnish nearly twice the needed



amounts of proteins, calcium, and the B vitamins, more than twice the needed amounts of iron and phosphates, and more than four times as much of vitamins A and C as is needed. Nutrition experiments on rats have shown that approximately such a "luxury" consumption of these dietary components constitutes an "optimal" diet, leading to earlier maturity and buoyant health. Thus it appears that although appetite unchecked cannot be trusted as regards quantity, it is an excellent guide to quality of diet.

**Overeating.** While hunger normally serves as a guard against undernourishment, appetite is frequently the cause of overeating. Skill in the preparation and serving of food cultivates an appreciation of the pleasant sensations associated with appeasement of hunger and makes eating a social pastime rather than a removal of the "gnawing" in the pit of the stomach. But even solitary gorging with food is practiced by persons who are otherwise maladjusted and need some sort of "escape" from the tedium of existence. Because carbohydrates (sugar, starches) are among the cheaper foodstuffs, they are indulged in more than proteins, and one often finds obesity to be associated with undernourishment with respect to proteins, minerals, and vitamins. See REDUCING DIETS AND DRUGS; STARVATION AND UNDERNUTRITION.

**Hunger Abnormalities** may take the form of excessive or deficient hunger. Granted that there is normally a considerable range in the intensity of hunger in different persons, or in the same person at various times, definitely abnormal hungers do exist. *Polyphagia*—excessive food intake—is seen in diabetes and is explained as the necessity to make up for the nutritive material (sugar) lost via the kidneys. *Bulimia* is the term applied to a marked sensation of hunger that leads to frequent eating, without, however, an increase in the total food intake. Morbid hunger has been produced in animals by brain injuries and often occurs in human beings as a result of brain lesions. Sometimes a brain operation, relieving the condition, leads to the abolition of morbid hunger. These cases strongly suggest the existence of a central component in the mechanism of normal hunger.

*Anorexia*—lack of hunger—may appear under a variety of physiological and psychological conditions. Salmon as they make their way up the rivers to spawn do not feed for weeks or even months. Wild animals in captivity often refuse to eat for a long time. In human beings grief or other depressing emotional experiences may lead to a refusal to eat. This condition, which is called *anorexia nervosa* and is most common in young women, may lead to a loss of 50 per cent of the body weight. Anorexia, extreme emaciation, and mental depression are also symptoms in women suffering from Simmonds' disease, a condition due to decreased activity of the pituitary gland. In this disease, however, there is a passive acceptance of food, while victims of nervous anorexia actively resist attempts to feed them. Many fevers lead to a loss of hunger and result in considerable wasting of body substance. Finally, chronic alcoholics often develop anorexia, as there is a considerable food value to the alcohol they consume.

#### SPECIFIC HUNGERS

How hunger, unspoiled by appetite, can serve as an unfaithful guide in NUTRITION is shown by a great variety of observations on "self-selection" of diet by animals and young children. The sense of taste is very important in nutrition. Such observations give indisputable evidence of the existence of different hungers related to specific needs, although the mechanism of these is not understood.

**Experimental Evidence.** When exposed to a number of bins each containing one of the usually recognized constituents of an adequate diet, young animals will often partake of just enough of each to achieve a better growth and development than can

be attained by a prepared mixture of foodstuffs. Rats, omnivorous like man and often used for dietary studies, have been observed to go first for sugar, then for wheat, and last for fat—when all three were simultaneously and equally accessible. If deprived of fat for some days, the rats go for fat first, instead of last, and the same applies to wheat. In a like manner, rats betray a special craving for such water-soluble vitamins as thiamine and riboflavin, but not for the fat-soluble vitamins. During pregnancy rats show an increased craving for calcium, phosphorus, and other minerals required by the developing young. They also consume more protein and fat, but rather less carbohydrate. Changes in food preferences also occur during lactation.

Observations of rats after loss of one of the ENDOCRINE GLANDS have provided evidence of other hungers. Surgical removal of the PITUITARY GLAND from these rats leads to a greatly decreased food intake, which has also been noticed in human beings suffering from pituitary deficiency. When deprived of the PARATHYROID GLANDS, rats will take in more calcium and less phosphorus than prior to the operation. A most striking craving for sodium salts has been observed in rats after extirpation of the ADRENAL GLANDS. Absence of the adrenal glands produces a mineral imbalance which is rapidly fatal unless righted by a greatly increased intake of sodium. Under normal conditions, rats prefer to drink water containing a little table salt (NaCl). But if given a choice between plain water and water containing less than 0.05 per cent salt, the rats no longer show a preference for the salty water; presumably normal rats cannot taste salt in such low concentration. Rats without adrenals are found to consume more salt, and if this is available only in the drinking water will drink enormous quantities of water. Under these special circumstances their taste for salt is so sharpened that they will prefer a solution of 0.003 per cent NaCl to plain water. Deprivation of the adrenals causes the acuity of their sensation for salt to be increased some 16 fold. That taste is the guiding sense is shown by the effect of cutting the taste nerves in these animals, when they at once lose the preference for salt water and die from adrenal insufficiency. Altogether, nine specific hungers have been demonstrated in the rat; other animals may have somewhat different hungers, depending on their diet.

**Young Children,** if given access to a variety of foods and left to themselves, will usually pick out sufficient amounts of the various constituents to make up a good diet. When mothers insist that children eat the same things every day, a psychological antagonism to otherwise acceptable foods is often developed. Occasionally children persistently refuse to partake of foods to which they are allergic. It is well known that the tendency of children to be finicky about their diet and to develop "feeding problems" is inversely related to the economic status of their families. To be contrary, children will often deliberately starve themselves. On the other hand, any so-called "unnatural" appetite in a child may be the result of some deficiency or specific hunger (see DEFICIENCY DISEASES). A case is reported of a 3½-year-old boy who while at home ate enormous quantities of table salt. When taken to a hospital and placed on a "normal" diet the boy died within a week; a postmortem examination showed that the cortex of his adrenal glands had been destroyed by disease. NATHANIEL KLEITMAN

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**HUNKERS**, the conservative faction in the New York Democratic party in the 1840's, opposing the liberal group known as the BARNBURNERS. The

Hunkers favored state-supported internal improvements and liberal banking laws and they deprecated antislavery agitation. During most of the period the Hunkers controlled the party machinery and patronage. A partial reconciliation took place with the Barnburners in 1852. Thereafter the two factions were generally designated as Hards and Softs, most of the Hunkers entering the former group.

**HUNS**, a people of Tartar or Ugrian stock, who in the third century B.C. seem to have dominated the whole of northern Asia, from the Ural Mountains to the Straits of Korea; and the famous Great Wall of China was erected at this time to check their inroads. The Huns, however, unsurpassed as horsemen and archers, moving from place to place with marvelous swiftness, capable of enduring any hardships, and brave to the extreme of ferocity, speedily overcame their civilized foes—e.g., the Chinese, over whom they exercised for some time a savage suzerainty. This galling tyranny was, however, shaken off by the Chinese in the following century, and the Huns themselves were reduced to vassalage, or compelled to wander westward in search of new conquests.

When the Huns first appeared in Europe remains a matter of conjecture; but crossing the Volga, they overthrew the kingdom of the Alans about 374, and pressed on at once to the conquest of the Gothic empire. Classic writers refer to "the shrill voice, the uncouth gestures, and the strange deformity of the Huns. They were distinguished from the rest of the human species by their broad shoulders, flat noses, and small black eyes, deeply buried in the head; and they were almost destitute of beards." Later writers point to the great size of their canine teeth; and more than once they are accused of cannibalism. The Huns are described as using bows and arrows, sabers, javelins tipped with bone, and slings or lassoes. At the same time, "the trappings of their horses, their swords, and even their shoes, were studded with gold and precious stones; and their tables were profusely spread with plates and goblets, and vases of gold and silver, which had been fashioned by the labor of Grecian artists." Certain magical attributes were ascribed to the Huns as a race. Like the modern Lapps, they were believed to have the power of raising storms of wind and rain at pleasure; and **ATTILA** was dreaded not only as a powerful monarch, but as a great magician.

Supreme between the Danube and the Volga, the Huns successfully invaded Persia, terrorized Syria, and threatened Italy; and in 446 Attila was in a position to dictate to the Byzantines a treaty by which they surrendered a part of their territory, paid an immediate indemnity of 6,000 pounds weight of gold, and agreed to pay 2,100 annually to the suzerain Attila. Four years later the Huns invaded western Europe, but in 451 in the battle of the Catalaunian Fields (probably south of Châlons-sur-Marne, the traditional site) they suffered a defeat which was a serious check to their military power. In this engagement Attila's great army, estimated at half a million, was defeated by the combined armies of the Romans and Visigoths, under Aetius and Theodoric. The next year Attila invaded Italy and menaced Rome; again he was turned back but he plundered and devastated many of the Roman cities. The power of the Huns collapsed in 453 with Attila's death. See **CATALAUNIAN PLAINS**, **BATTLE OF**.

For several centuries the Huns continued to figure in European history, their home being chiefly in the Danube region, from which they issued to battle with Charlemagne, and, in the 9th and 10th centuries, to ravage Italy and Germany.

Although Hungary may owe its name to the early Huns, the present Hungarians, the Magyars, are descended from immigrants of the ninth century, who came as successful invaders from the East. Whether the Huns who ravaged Italy in the ninth and tenth centuries were mainly of the old Hun race, or were their Magyar conquerors, is something of a problem.

**HUNT, GEORGE WYLIE PAUL**, 1859-1934, American politician, was born in Huntsville, Mo. He left home in 1878 and became a prospector, miner, railroad construction hand, and boatman in the West, settling in Globe, Ariz., in 1881. A friend of organized labor, he was a member of the territorial legislature (1892-1900, 1904-10), and president of the Arizona state constitutional convention (1910-11). The first governor of the state, he served seven terms in all (1912-19, 1922-28, 1930-32).

**HUNT, HELEN**, See **JACKSON, HELEN FISKE HUNT**.

**HUNT, HENRY JACKSON**, 1819-89, American soldier, was born in Detroit, Mich., graduated from West Point in 1839, took part as a lieutenant in the Mexican War, and was brevetted captain for his services at Contreras and Churubusco, and major for his services at Chapultepec. He entered the Civil War as major, became a brigadier general of volunteers in September, 1862, and was chief of artillery of the Army of the Potomac (1862-65). At **GETTYSBURG** his artillery engaged in a famous duel with the Confederate guns, and its fire helped break up Pickett's assault.

**HUNT, JAMES HENRY LEIGH**, 1784-1859, English poet and essayist, was born in Southgate, Middlesex, and was educated at Christ's Hospital, London. In 1808, with his brother, he founded the *Examiner*, which he edited for 13 years, and through whose columns Keats and Shelley were presented to the public. In 1812 an article on the prince regent led to Hunt's imprisonment for two years. While serving his sentence he continued to edit the *Examiner*; published a volume of verse, *A Feast of the Poets* (1814); and began his most ambitious poem, *The Story of Rimini* (1816), which was



Leigh Hunt

aply described by Byron as "a niminy-piminy story of Rimini." *Rimini, Hero and Leander* (1819), and the dithyrambic *Bacchus in Tuscany* (1825) were prime examples of bathos in poetry and won Hunt the title of "leader of the Cockney school." His real poetical genius found expression in such short flights of fancy as "Jenny Kissed Me" and "Abou Ben Adhem." The best of his Addisonian essays appeared in his journals, which besides the *Examiner* included: the *Liberal* (with Byron, 1822); the *Indicator* (1819-21); the *Companion* (1828); the *Tatler* (1830-32); and *Leigh Hunt's London Journal* (1834-35). Among Hunt's other publications were a memoir of Byron (2 vols. 1828) which he later made the basis of his own gossip autobiography (3 vols. 1860); *Imagination and Fancy* (1844); *Wit and Humour* (1846); *Stories from the Italian Poets* (1846); *Men, Women and Books* (1847); *The Town; its Memorable Characters and Events* (2 vols. 1848); *Table Talk* (1851). The definitive collection of his poetical works was edited by H. S. Milford (1923). J. J. M.

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**HUNT, RICHARD MORRIS**, 1828-95, American architect, the brother of **WILLIAM MORRIS HUNT**, was born in Brattleboro, Vt., and attended high school in Boston. In 1843 he visited Europe with the object of pursuing his studies in architecture, entering the studio of Lefuel in Paris, by whom he was subsequently appointed inspector of works on the buildings connecting the Tuileries with the Louvre. Returning to America in 1855, he spent his later life in New York. He designed the Lenox Library building in New York, the United States naval observatory at Washington, and the fine Administration Building for the World's Columbian Exposition at Chicago, the Yorktown monument, many fine villas at Newport, and a type of business edifice in New



York which became identified with his name. He was one of the founders, the first secretary, and the third president (1888-91) of the American Institute of Architects. Shortly before his death, he received the unusual honor of election to an associate membership of the Académie des Beaux-Arts.

**Richard Howland Hunt**, 1862-1931, his son, was also an architect. He completed, from a sketch of his father's, the new wing of the Metropolitan Museum of Art.

**HUNT, WARD**, 1810-86, American jurist, was born in Utica, N.Y., and graduated from Union College. Admitted to the New York bar in 1831, he practiced in Utica, and in 1844 was elected mayor of that city. He was representative in the state assembly (1829-40), judge in the court of appeals (1865-68), and chief justice of the court of appeals (1868-72). He was appointed to the U.S. Supreme Court in 1872 by President Grant. Paralyzed in 1879, he was permitted to retire in 1882 by special act of Congress.

**HUNT, WILLIAM HENRY**, 1790-1864, English water-color artist, was born in London, and was a cripple from childhood. His first exhibits at the Royal Academy were in oil, but subsequently he devoted himself to water color, and became a brilliant colorist. His subjects were mostly country scenes, as the interiors of barns and cottages, smithies, and fisher folk. "Too Hot," "The Eavesdropper," "Roses in a Jar," are characteristic of his work.

**HUNT, WILLIAM HENRY**, 1824-84, American lawyer and political leader, was born in Charleston, S.C. He was educated at Yale, and moved with his parents to New Orleans in 1845, where he was admitted to the bar and soon became prominent in his profession. He was one of the few influential Louisianians who favored the Union cause during the Civil War, and acted with the Republicans during the Reconstruction period. In 1876, as the Republican candidate on the Packard ticket, he was defeated in a bitter contest with his Democratic opponent, on the Nicholls ticket, for the position of attorney general of Louisiana, both claiming to have been elected. He was a judge of the U.S. Court of Claims (1878-80), and was secretary of the navy from March, 1881, until April, 1882. From 1882 until his death at St. Petersburg he was the minister plenipotentiary of the United States to Russia.

**HUNT, WILLIAM HOLMAN**, 1827-1910, English religious painter, whose naturally mystical and symbolic mind, expressing a profound religious temperament, and natural genius, made him a potent force in the pre-Raphaelite movement. He was born in London, was educated in the Royal Academy Schools, and exhibited his first work in 1846. This was followed by scenes from Dickens and Scott, and by the more important "Flight of Madeline and Porphyro," from Keats' *Eve of St. Agnes* (1848). At this period Hunt shared a studio with Rossetti, and the pair, along with Millais and a few other earnest young painters, inaugurated the "Pre-Raphaelite Brotherhood." Hunt's "Hiring Shepherd" was shown in 1853, and was followed by "Awakened Conscience" and his world-famed "Light of the World" (1854), to which may be traced much of later religious art in England and abroad. Thereafter followed "The Scapegoat" (1856); "Christ Discovered in the Temple" (1860); "The Triumph of the Innocents" (1885); "Isabella and the Pot of Basil," and others. See PRE-RAPHAELITES.

**HUNT, WILLIAM MORRIS**, 1824-79, American painter, was born in Brattleboro, Vt., and studied for three years at Harvard. He studied painting under Couture at Paris, whose novel methods of producing lights and shades he quickly mastered. He was one of the earliest discoverers of Millet, whose famous picture "The Sower" he purchased, and whom he visited at Barbizon. Returning to America in 1855, he established himself in Boston and from that time on exerted a considerable in-

fluence on American art. His studio talks with his pupils have been collected and published. His most famous commission was the decoration of the ceiling in the Capitol at Albany, N.Y., with his two paintings, "The Flight of Night" and "The Discoverer." Portraits of Chief Justice Shaw, Senator Evarts, and Mr. Sumner, "The Prodigal Son," "The Drummer Boy," and "Charles River" are well known works.

**HUNT, WILSON PRICE**, c. 1782-1842, American explorer, was born in Hopewell, N.J., and moved to St. Louis in 1804. As a partner of JOHN JACOB ASTOR in the Pacific Fur Company, he commanded the Astoria expedition which was the first cross-continent expedition, after Lewis and Clark's. Attempting to cross the Snake River, the expedition broke up into several groups which after great hardship reached Astoria in 1812. Leaving Astoria in 1814, he sailed around Cape Horn and returned to St. Louis where he became postmaster (1822-40).

**HUNTER, DAVID**, 1802-86, American soldier, was born in Washington, D.C. He was graduated from West Point in 1822, resigned his military commission in 1836, and engaged in business in Chicago, but re-entered the service in 1841. He served as major under General Wool in the Mexican War, and as brigadier general and major general of volunteers in the Civil War, during which he was the commander of the main column of McDowell's army in the first Battle of Bull Run, the successor of Frémont as commander of the Western Department, and then commanded in turn the Department of the South, including South Carolina, Florida, and Georgia. He issued, on May 9, 1862, a famous order immediately annulled by President Lincoln, freeing the slaves in this department. He commanded the Department of West Virginia (1864-65), and threatened Lynchburg, but allowed Early to approach Washington. He was president of the military commission which tried Mrs. Suratt, Atzerodt, and others charged with being implicated in the assassination of Lincoln.

**HUNTER, JOHN**, 1728-93, British anatomist and surgeon, was born in Long Calderwood, Lanarkshire, Scotland. Joining his brother, WILLIAM HUNTER, in London in 1748, he assisted him in the dissecting room and showed such an aptitude that he was admitted to Chelsea Hospital as a surgeon apprentice. He later became house surgeon at St. George's Hospital (1756) and was an army surgeon during the concluding years of the Seven Years' War in Portugal. Hunter discovered the circulation in the human placenta (1780) and the method of ligating the artery in cases of aneurysm (1785). He also established the existence of a system of collateral circulation by anastomosing branches of arteries. He wrote *The Natural History of the Human Teeth* (1771), *Recovery of the Apparently Drowned* (1776), *A Treatise on the Venereal Disease* (1786), and *A Treatise on the Blood, Inflammation, and Gunshot Wounds* (1794).

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**HUNTER, ROBERT MERCER TALIAFERRO**, 1809-87, American political leader, was born in Essex County, Va. He was educated at the University of Virginia and at the Winchester (Va.) Law School, was admitted to the bar in 1830, and soon became a prominent member of the Virginia bar. He was a representative in Congress (1837-43 and 1845-47), was speaker of that body (1839-41), and was a U.S. senator from 1847 until 1861, when on the secession of his state he resigned and cast in his fortunes with the Confederacy. He was then secretary of state of the Confederate States (1861-62), was a Confederate senator (1862-65), and was one of the Confederate representatives at the Hampton Roads conference.

**HUNTER, WILLIAM**, 1718-83, Scottish anatomist and obstetrician, elder brother of JOHN HUNTER, was born in Long Calderwood, Lanarkshire, and left

Edinburgh for London in 1741. He was in 1768 appointed the first professor of anatomy to the Royal Academy. His collection of specimens now forms the Hunterian Museum at Glasgow University. His great work was *The Human Gravid Uterus* (1774, ed. 1843).

**HUNTER, Sir WILLIAM WILSON, 1840–1900**, British Indian historian and geographer, was born at Aberdeen. As director general of statistics, he planned and carried out the first Indian census (1872). After retiring (1887) to England, he interested himself in Oriental studies at Oxford and in literary work. Under his superintendence were produced a *Statistical Survey of India* (128 vols.) condensed for the *Imperial India Gazetteer* (9 vols. 1881); *Bengal and Assam* (22 vols. 1875–79); *Rulers of India Series* (1890–95). He also produced a *Dictionary of Non-Aryan Languages of India and High Asia* (1868), *Orissa* (1872), and *The Indian Empire* (1895).

**HUNTER COLLEGE OF THE CITY OF NEW YORK.** See COLLEGES.

**HUNTER'S MOON**, the full moon that follows the HARVEST MOON and has only a slightly greater retardation in rising than the latter. At mid-northern latitudes, therefore, the hunter's moon rises less than half an hour later each evening than on the preceding one so that, as for the harvest moon, there is a succession of several long moonlight nights in the early fall. See PHASE.

**HUNTING**, the pursuit of wild game for a purpose, but especially for sport. Hunting as a pastime is an ancient practice; depictions of wild beasts with hunters in pursuit are found on Assyrian and Egyptian sculptures. Hounds were in common use, while even lions were trained to follow game. The Greeks hunted big game on horseback or by trapping, and were particularly fond of hare hunting, as may be seen from Xenophon's *Cyngeticus*. In modern times stag hunting, fox hunting, other hunting, the hunting of game birds, and the hunting of big game are all engaged in.

**Hunting Small Game** ranks next to fishing as the outdoor sport actively participated in by the greatest number of inhabitants of the United States. The total number of hunters can not be estimated with any accuracy, since thousands of farmers, farm boys and persons living in sparsely populated regions hunt for sport or meat without hunting licenses. The number of licensed hunters, however, has increased by between 25% and 30% since the end of World War II. Small game hunting is not only a big sport; it is a big business. Recent statistics, based on surveys by the U.S. Fish and Wildlife Survey, indicate that hunters and fishermen spent approximately four billion dollars in 1946 for guns, ammunition, equipment, dogs, and travel expenses to and from hunting and fishing grounds. According to the survey, the average sportsman spends \$5 for each duck or small bird he shoots, \$10 for each wild goose. Two million Federal duck stamps, permitting the holder to shoot ducks legally, were sold during 1946. Rabbit hunting is probably the branch of the sport most widely indulged in. Quail and partridge hunting with dogs is probably next in popularity. Pheasant hunting reached a peak in 1944 and has declined since, due to poor hatching conditions shortening the supply of pheasants and resulting in more stringent game laws. Grouse, doves, banded pigeons (in the Southwest), raccoons, opossums and squirrels are other forms of small game that are widely hunted. Most small game is hunted afoot, usually with dogs to locate and flush the game. Ducks, increasingly, are shot from blinds built on the marshy shores of lakes or rivers where the birds stop to feed on their migrations South. Decoys shaped like ducks and duck calls are used to attract the fowl within shooting range of the blinds where the hunters stand concealed by reeds or foliage. Retriever dogs are used to retrieve the ducks from the water or marsh where they fall after being hit.

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**Hunting Big Game.** The term "big game" may be said to include all wild mammals larger than the ordinary fox. Advancing civilization long ago caused the partial or total disappearance of these wild creatures within closely settled districts but certain of the larger and fiercer species have persisted in a portion, at least, of their ancient domain, particularly where dense forests or lofty mountains have afforded retreats. The establishment of game preserves and the enactment of stringent game laws in recent years are manifestations of a desire to conserve wild life from the danger of extermination at the ruthless hand of the hunter.

In olden times Europe was undoubtedly a magnificent hunting ground but, owing to indiscriminate slaughter, the great store of game has been practically wiped out. The remnant is chiefly gathered in protected preserves of royal and noble families and guarded by law. The remote and sparsely populated parts, however, still hold some few wild animals free to the sportsman. Elk are found in Scandinavia, Russia and Finland; bears in Russia and in the Balkan States; roe and red deer in Austria, France, Galicia, Belgium and Holland; and chamois on the slopes of the Alps and Apennines and in Tuscany and Austria. Wolves, wild boar and wild sheep exist in limited numbers.

The Himalayas and India, in Asia, are the greatest nursery and preserve of game in the world outside central Africa. Every kind of country from desert to jungle and every altitude and climate, from the glacier-meadows of the Pamir and Mongolia to the salt marshes of the Ganges Delta, offer shelter and sustenance to wild animals large and small. The lion is now to be found only in certain arid hills on the Afghan frontier. The tiger, on the other hand, ravages everywhere that forest, swamp, or mountain will furnish him refuge. The determined sportsman need rarely go far or search long in any part of India or Malaya before encountering this beast, especially in the morasses along the coasts of the Bay of Bengal, and on the Malayan Peninsula and islands. It occurs also eastward to Formosa, northern China, and Sakhalin. Even more numerous and widespread is the leopard, or panther, and perhaps equally destructive are several other large and fierce cats. The brown bear abounds throughout southern Asia, and its pursuit is among the most dangerous of Eastern sports. In the open grounds wolves, hyenas, and

Small game hunter and dog take to the field

BAUSCH & LOMB





jackals range in packs, and are hunted with hounds as well as shot, while various wild dogs are the terror of the jungle. Here, too, is followed the exciting chase on horseback of the wild boar, the spearing of which, or "pigsticking," is considered excellent sport.

The elephant ranges over the higher parts of central India, Burma, Siam, and in Ceylon, but it is well protected by law. Rhinoceroses of three species may be had in swampy forest tracts from the Ganges Delta southward to Cochinchina and Borneo. In the same stretch of tropical jungles wild oxen are to be hunted, especially the gaur (Indian "bison" or *sladang*), which is as dangerous to meet as a tiger. The sportsman's powers of climbing and skill in stalking may be tested by the wild yaks or any of a dozen varieties of sheep, ibexes, and goat-antelopes, inhabiting the heights of the central Asian plateaus and mountain systems. Lastly, on these plateaus, as well as on the lowland plains, wander several kinds of antelopes, deer (some much like the American *wapiti*), wild asses, and smaller quarry.

Africa has long been known as pre-eminently the home of strange and wonderful forms of life which here have remained longest undisturbed. Within the last century, however, European settlement and the acquisition of firearms by the native tribes have caused the extermination of game over wide areas. In certain districts south of the Zambesi, however, and in the semi-desert tracts which extend northward from Bechuanaland to Angola, big game survives in large numbers. British East Africa contains an abundance of big game and there are enormous areas of the continent where big game hunters are able to find in their native haunts every species of wild animal which is indigenous to Africa. Most characteristic of these are the elephant, lion, leopard, hippopotamus, giraffe, antelope, gorilla, rhinoceros, buffalo and zebra.

The fate of big game in America has been similar to that of other regions. The bison, which two centuries ago came east to the Alleghenies, was reduced to only a few protected bands kept as curiosities, but in 1902 Congress took steps to prevent the beasts' extinction. Within 20 years the bison had multiplied to a point where feeding became a problem, and in 1943 there were more than 5,000 of the animals in the United States. The *wapiti* or elk, once equally wide-ranging, is now to be seen only in the northern Rocky Mountains, and can hardly be called a game animal south of British Columbia. Moose and woodland caribou may still be shot, when local laws permit it, in eastern Canada, Maine, northwestern Canada, and parts of Alaska. The more reindeer-like barren grounds caribou still migrate annually in countless herds between the Arctic coast and the northern border of the forest lands, but, like the musk oxen of that region, are beyond the reach of most sportsmen. A similar inaccessibility has preserved thus far the white goat-antelope which wanders in small bands along the crests of the mountains of western Canada and Alaska. The big-horned wild sheep, once common throughout the whole mountainous west, is now rare south of the Canadian boundary.

The other beautiful game animals of the West have been nearly destroyed—the mule deer and the pronghorn—both of which are now few and scattered in remote and unfrequented localities, although half a century ago they were to be found everywhere in countless numbers west of the Missouri River. Good sport may still be had with the mule deer in various parts of the mountain region; and also with its cousin, the Columbian blacktail of the Puget Sound region. The small, common, white-tailed deer remains scattered over nearly every state in the Union, but in the older states can be shot only under such restrictions that it is practically removed, except in the South and West, from the list of game animals. Similar species abound in Mexico.

The forests and mountains of the eastern states and Canada still shelter a fair number of black bears, but on account of their depredations on sheep and pigs, they are treated more as a pest than game. The puma long ago disappeared from the eastern half of the country, but the northern lynx and southern and western bobcat still dwell in the wilder parts of the East, and are trapped or poisoned. Pumas exist in the swampy forests and canebrakes of the lower Mississippi and Gulf coast, but otherwise are to be found only in the Rocky Mountains, and on the Pacific slope, where they ravage the livestock of ranches, and, with the two bears—the grizzly and the black—furnish good sport.

The puma is to be found throughout Central and South America, as is also the fiercer and braver jaguar. There are several other smaller tropical American cats. The tapir is the largest of the animals to be hunted in the American tropics, but its pursuit offers little sport. In fact, sport is not to be had, or big game of consequence obtained in South America, until the pampas of Argentina are reached, and there guanacos and ostriches (rheas) are about all that properly come under the head of big game, except the puma and jaguar—the latter not known south of Paraguay. The rapid settlement of the Argentine plains is making all game scarce north of the arid regions of Patagonia.

Among the best known hunters who have made expeditions in search of big game both for the sake of sport and in the interest of science are CARL AKELEY, who made three trips to Africa and brought back valuable specimens and wrote instructive articles on his experiences; Paul Rainey, who has hunted big game in the Rockies, in the Arctic regions, and in British East Africa, and has photographed many wild animals in their native haunts; THEODORE ROOSEVELT who in 1909 was sent by the Smithsonian Institution of Washington on an expedition to British East Africa to obtain specimens of wild animals in that region; Mr. and Mrs. MARTIN E. JOHNSON who wrote much of experiences in Africa and elsewhere; and Frank Buck whose chief purpose was to capture animals for showmanship enterprises. Remarkable moving picture films have been made of African animals never before pictured in their native haunts.

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**HUNTING DOG or HYENA DOG**, an inhabitant of the plain regions of east and south Africa. The hunting dog, *Lycan pictus*, is about the size of a wolf but has a larger head in relation to body size. The body is blotched with yellow, black, and white. The dogs hunt in packs of about 20. These packs are serious pests because they prey upon domesticated animals as well as gnus and hartebeests.

Dogs of registered breeds belonging to the sporting dog and hound groups are often called hunting dogs. See Dog.

**HUNTINGDON, SELINA HASTINGS, COUNTESS OF**, 1707-91, English religious philanthropist, was born in Stanton Harold. Widowed by the ninth Earl of Huntingdon in 1746, she became a zealous Methodist and appointed George Whitefield as her chaplain. Through her influence Methodism gained many important converts among the English nobility and she founded a sect of Calvinistic Methodists known as the Countess of Huntingdon's Connection. Under the misconception that her title gave her ecclesiastical authority she built a number of chapels, appointing or removing their ministers according to her own pleasure. After her death most of the churches of her sect joined the Congregationalists.

**HUNTINGDON**, municipal borough, E central England, county seat of Huntingdonshire, on the Ouse; 18 miles S of Peterborough and 59 miles N of London. Near the town is Hinchingsbrooke House, the residence of the Cromwell family, and the birthplace of Oliver Cromwell. In All Saints Church are several monuments to the family. The town was a station on the old Roman road, Ermine Street, and is the center of a rich farming region. A 13th century bridge connects it with Godmanchester. Industries include manufactures of motor cars and engineering machinery, iron foundries, breweries, and tree nurseries. Pop. about 4,000.

**HUNTINGDON**, borough, S central Pennsylvania, county seat of Huntingdon County, on the Juniata River, the Broad Top Mountain and the Pennsylvania railroads, and U.S. Highway 22, 97 miles NW of Harrisburg. Originally a village of the Oneida Indians, Huntingdon was founded in 1767 by the Rev. William Smith, then provost of the University of Pennsylvania. It was named for the Countess of Huntingdon, who contributed funds to the University of Pennsylvania. The borough is the seat of Juniata College. Bank books, stationery, reflecting paint, and Fiberglas are the chief industrial products. Pop. (1950) 7,330.

**HUNTINGDON COLLEGE**. See COLLEGES.

**HUNTINGDONSHIRE**, or **Hunts**, inland county, E central England, bounded on the W and N by Northampton, on the E by Cambridge, on the S by Bedford; area 365 sq. mi.; pop. (1950 est.) 68,000. Huntingdonshire is one of the smaller Midlands counties. The southern and western sections are undulating, with low hills; the east section is in the Fens district, the famous Bedford Levels occupying many hundreds of acres in the northeastern part of the county. The chief rivers are the Ouse, Kym, and Nene, the latter forming a part of the northwestern border. The shire is a rich farming region, having 200,000 acres under cultivation. Crops include wheat, oats, barley, potatoes, beans, peas, sugar beets, and hay grasses. Sheep, cattle, and pigs are raised. Bees are kept, and honey is exported. The village of Stilton is famed for its cheeses. Industries include fisheries, and the manufacture of bricks and tiles, paper, leather goods, laces, yarn, straw-plating for furniture, and beer and malt. Numerous remains have been found, including prehistoric, Roman, and Danish. At Huntingdon are the Norman castle Kimbolton and an arched medieval bridge. The chief towns are Huntingdon, the county town, and Godmanchester, St. Ives, Ramsey, and Holme. The section was a center for receiving evacuees from London and other bombed-out English cities during World War II.

**HUNTINGTON, COLLIS POTTER**, 1821–1900, American railroad financier and entrepreneur, was born in Harwinton, Conn. He began to support himself at 14, and at 15 became a traveling salesman in the South. With his brother he opened a general store in Oneonta, N.Y. (1842), which he left in 1849 to emigrate to California. There for a time he sold hardware supplies to miners.

In 1860 Huntington associated himself with Charles Crocker, Mark Hopkins, and Leland Stanford, in financing the proposed CENTRAL PACIFIC RAILROAD, engineered by Theodore Dehone Judah. Judah and Huntington obtained necessary government aid, and during its construction (1861–69), took care of the financial interests in the East. After the completion of the Central Pacific, he and his partners were active in building the SOUTHERN PACIFIC RAILROAD. The Southern Pacific Railroad Company was organized in 1884 as a controlling corporation for the entire system. Huntington was vice-president and general agent for the Central Pacific, agent and attorney for the Southern Pacific, and vice-president of the Southern Pacific Railroad Company. He was a director of the latter two organizations, and in 1890,

after a break with LELAND STANFORD, succeeded him as president of the Southern Pacific Railroad Company. He acquired and was president of the Chesapeake and Ohio Railroad in 1869, and by extending it to the eastern seaboard at Newport News, Va., made it a financial success. He was president also of the Pacific Mail Steamship Company, and had interests in other railroads and steamship lines. C. A.

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**HUNTINGTON, DANIEL**, 1816–1906, American painter, a member of the "Hudson River group," was born in New York, and was for some time a student at Hamilton College. He studied painting with Morse and Inman (1835) and began work among the Hudson Highlands in 1836. After completing his art studies in Rome and Florence (1839), he devoted himself, as far as more lucrative portrait painting would permit, to historical and genre work, his interpretations of *The Pilgrim's Progress* and of scenes from Irving's *Sketch Book* being especially noteworthy. He visited England in 1851, and there painted several portraits, notably those of Sir Charles Eastlake and the Earl of Carlisle. He was president of the National Academy in 1862 and 1869, and again in 1877–91. His work includes portraits of Lincoln, Agassiz, W. C. Bryant, and others; "A Toper Asleep," "Mercy's Dream," "Henry VIII and Catherine Parr," "Chocorua," "Republican Court," "Goldsmith's Daughter."

**HUNTINGTON, ELLSWORTH**, 1876–1947, American anthropogeographer, was born in Galesburg, Ill., and studied at Beloit College and Harvard and Yale universities. In 1907 he began teaching geography at Yale, becoming research associate in 1917. Known for studies of climate and the relation between environment and the progress of culture, he investigated the effect of climatic fluctuations upon man's health, energy, and earning power. He concluded that a stimulating climate (such as that of the temperate zones) plays an important part in determining the development of higher civilizations. Huntington wrote: *World Power and Evolution* (1919); *The Character of Races as Influenced by Physical Environment, Natural Selection and Historical Development* (1924, ed. 1927); *Season of Birth* (1938); *Civilization and Climate* (1915, ed. 1939); *Main Springs of Civilization* (1945).

**HUNTINGTON, HENRY EDWARDS**, 1850–1927, American railroad executive, founder of the HUNTINGTON LIBRARY and Art Gallery, was born in Oneonta, N.Y. Associated with his uncle, Collis P. Huntington, in the railroad business (1871–1900), he sold to E. H. Harriman the controlling interest he had acquired in the Southern Pacific when his uncle died (1900). Becoming a dominant figure in the electric power and real estate business of Southern California, he built a private estate in San Marino where he located the library and art gallery which became his chief interest after 1910. A board of trustees was named to administer the estate for the public after his death.

**HUNTINGTON, WILLIAM REED**, 1838–1909, American Protestant Episcopal clergyman, born in Lowell, Mass. A graduate of Harvard (1859), he was ordained in 1862 and served as curate of Emmanuel Church, Boston (1861–62), and held the rectorates of All Saints Church, Worcester, Mass. (1862–83) and Grace Church, New York City (1883–1909). He was a believer in church union and active in the establishment and erection of the Cathedral of St. John the Divine (New York City), which contains a chapel named in his honor. His publications include *The Church Idea* (1870); *Sonnets and a Dream* (1904); *A Good Shepherd and Other Sermons* (1906).

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**HUNTINGTON**, city, NE Indiana, county seat of Huntington County, on the Little Wabash River



at its confluence with the Wabash, on the Erie and the Wabash railroads and U.S. highways 24 and 224; about 25 miles SW of Fort Wayne. Huntington was settled in 1834 and named for Samuel Huntington of Connecticut, a signer of the Declaration of Independence. Huntington College is located here. Huntington has limestone quarries, large grain elevators, and railroad repair shops, and the manufacture of brake linings, rubber goods, furniture, furnaces, shoes, paint, coal chutes, butter barrels, and paper boxes. Pop. (1950) 15,079.

**HUNTINGTON**, town, SE New York, in Suffolk County, on the N shore of Long Island, and the Long Island (Pennsylvania) Railroad, 35 miles E of New York City. Huntington is chiefly a residential suburb which was settled in 1653. Nathan Hale was captured by the British a short distance from here, and the town was the birthplace of Walt Whitman. Pop. (1950) 9,324.

**HUNTINGTON**, city, SW West Virginia, county seat of Cabell County on the Ohio River, the Baltimore and the Chesapeake and Ohio railroads, and U.S. highways 23, 52, and 60; about 50 miles W of Charleston. Huntington, the largest city of West Virginia, is a metropolis of the industrial tristate region formed by the meeting of the boundaries of Ohio, Kentucky, and West Virginia. It is situated in a region rich in tobacco, bituminous coal fields, and gas and oil wells. Monel metal, nickel products, glass products, optical lenses, furniture, clothing, beer, veneer, shoes, and steel are made in Huntington. It was founded as a terminus of the Chesapeake and Ohio Railroad in 1869 and named for the president of the railroad, Collis P. Huntington. Marshall College, established in 1837, is located here. Pop. (1950) 86,353.

**HUNTINGTON BEACH**, city, S California, in Orange County; on the Pacific Ocean, the Pacific Electric Railway, and U.S. Highway 101A, about 12 miles SW of Santa Ana in an oil field. First known as Pacific City, the city was renamed for a railroad promoter in 1904, when the townsit was acquired by a land syndicate. Since the discovery of oil in 1920, the city's chief interests are in oil wells along the beach, oil refineries, and the manufacture of oil-well equipment. Some truck crops are grown near by. Pop. (1950) 5,237.

**HUNTINGTON LIBRARY AND ART GALLERY**, full name, **Henry E. Huntington Library and Art Gallery**. Founded by trust in San Marino, Calif., in 1919, with a self-perpetuating board of trustees, the Huntington Library is considered the greatest research library in its field in the western part of the United States. It was planned and brought together by its founder, HENRY E. HUNTINGTON (1850-1927), a New Yorker and Californian. The main collections of books, manuscripts, and pictures were assembled in fewer than 20 years, and yet they rival in some respects those of the great public libraries and galleries of the United States and England.

The institution comprises three principal divisions: the library, art gallery, and botanical gardens. The estate contains 207 acres and is about 12 miles from Los Angeles. The library building was constructed in 1920, at which time the Huntington collection, including several famous libraries, was transferred from New York to San Marino. It contains 250,000 volumes, 5,000 manuscripts, and 1,000,000 autographed letters and documents. It is available for use by research persons, as is a large photostat department. Special collections include American and English literature from the beginning of printing in England to the 20th century; American history to World War I; American Civil and Revolutionary war materials; Washingtoniana, Lincolniana, and Californiana. The art gallery, formerly the Huntington House, completed in 1910, contains collections of paintings (the most famous is Thomas Gainsborough's "Blue Boy"), mainly portraits, by the masters of the 18th-century

British school, and furniture, tapestries, porcelains, bronzes, and other objects of art. In the library there is also a collection of Italian and Flemish paintings and 18th-century French objects of art. The botanical gardens comprise many distinctive gardens in which are found unusual subtropical trees and shrubs, cacti, succulents, cycads, etc. MILDRED OTHMER PETERSON

**HUNTINGTON PARK**, city, S California, in Los Angeles County, on the Santa Fe, the Union Pacific, and the Pacific Electric railroads, four miles SE of Los Angeles. Originally a residential suburb, Huntington Park has developed into a thriving industrial center. It has manufactures of steel castings, auto tires, furniture, pumps, oil field equipment, ornamental metals, glass specialties, and plows. Huntington Park was incorporated in 1906. Pop. (1950) 29,450.

**HUNTS**. See HUNTINGDONSHIRE.

**HUNTSVILLE**, town, Canada, in the province of Ontario, Muskoka District, on the Canadian National Railway; 145 miles N of Toronto. It has lumber mills, machine shops, and leather works. It is an important resort center for the Lake of Bays region. It was named for one of the first settlers, George Hunt. Pop. (1950) 16,437.

**HUNTSVILLE**, city, N Alabama, county seat of Madison County, on the Southern and the Nashville, Chattanooga, and St. Louis railroads, U.S. highways 72 and 241, and the Pennsylvania-Central and the Eastern air lines; about 125 miles N of Birmingham. Huntsville, a textile center, is beautifully situated in the heart of the Tennessee Valley about 10 miles from the Tennessee River. It was founded in 1805 by John Hunt, a Revolutionary War veteran from Virginia. Huntsville was the first settlement in Alabama to receive a charter. In 1819 it was the scene of the convention which drafted the state's constitution and of the first state legislative meeting. Oakwood College and the State Agricultural and Mechanical College for Negroes are located in Huntsville. In the center of the city is the Big Spring, source of Huntsville's water supply; the spring has a capacity of 24,000,000 gallons a day. Textiles, shoes, stoves, and wood products are the major manufactures of the city. Pop. (1940) 13,050.

**HUNTSVILLE**, city, E Texas, county seat of Walker County, on the Missouri Pacific Railroad and U.S. highways 75 and 190; about 75 miles N of Houston. It was settled about 1835. Huntsville is the seat of Sam Houston State Teachers College, the oldest in the state. The home of Sam Houston, who lived in Huntsville, is preserved on the school grounds and there is a memorial museum near it. General Houston is buried in the Oakwood cemetery. Huntsville has lumber and cottonseed oil mills. Pop. (1950) 9,820.

**HUNYADI, JÁNOS**, or **JOHN HUNYADY**, 1395?-1456, national soldier hero of Hungary, was probably born in Hunyad in Transylvania. He became prominent first in 1437, when he appeared on the battlefield and caused the defeat of the Turkish sultan at Semindria. It was his influence which brought about the election of Ladislaus of Poland as king of Hungary on the death of Albert, duke of Austria, and under the standard of this king he fought valiantly against the Turks, whom he defeated in 1441, and again in 1442. He was himself defeated at Varna, where Ladislaus was killed. During the minority of Ladislaus' successor, he was coregent and governor (1446-52) of Hungary. In 1448, deprived of support, owing to the jealousy of the Hungarian nobles and foreign sovereigns, he was defeated on the plain of Kossovo. His last and most famous achievement was the relief of Belgrade (1456), in which he was assisted by the monk Capistrano. Hunyadi has been looked upon as the savior of Christianity, for it was largely due to his efforts that the Turks failed to gain an entrance to central Europe by way of the Balkans. His son Matthias was later elected king of Hungary.

**HUON GULF**, an inlet on the SE shore of New Guinea. It has several good harbors, chief of which is LAE at the mouth of the Markham River.

**HUPA INDIANS**, an Athabaskan tribe of the Trinity River valley in northern California, noted for their excellent basketry. They now practice some agriculture and stock raising, but at the time of their first contacts with the whites they were dependent on wild foods. Acorn trees which grow in profusion in their territory furnished them with an ample supply of acorn meal. This was supplemented by wild roots and fruits, with salmon and deer. They were excellent hunters, famed for their ability to stalk game by disguising themselves with skins and imitating the acts of animals. Their villages were semipermanent and contained houses of two types. The largest was made of cedar slabs set on end and enclosing a space about 20 feet square. The central portion of the structure was excavated to a depth of about five feet. Such a building was used for storage and as a sleeping place for the women. The men occupied a more lightly built "sweat lodge." Family life such as is known to Europeans did not exist in this society. The man's dress consisted of a skin breech clout, leggings and moccasins. On special occasions he would don a skin or feather robe and wear a feather headdress. Women wore knee length skirts of skin which they decorated with strings of shell beads, pieces of abalone shell or pine nuts. As a protection against the cold they wore deer skin robes. They combed their hair in braids which fell in front of the shoulders and on their heads they wore basket caps. Facial tattooing was sometimes practiced. Chieftainship was more strongly developed than in most California tribes. There was also a dual division of the society which functioned during ceremonies but not at other times.

FAY-COOPER COLE

**HUPEH**, province, central China, in the Yangtze Valley; bounded on the N by Honan; E by Anhwei; S by Kiangsi and Hunan; and W by Szechwan and Shensi; area 71,955 sq. mi.; pop. (1947) 24,659,000. It is enclosed by low mountains, the Wu Tang Shan on the north; the Ta Pieh Shan, northeast; the Kiu Ling Shan, southeast; the Shihpa Shan, southwest; and the Ta Pa Shan in the west. The Yangtze and Han rivers intersect the province, and there are numerous lakes and canals. The principal trade routes of China pass through Hupeh Province. Its fertile, agricultural sections are the central and southeastern parts, which produce rice, wheat, cotton, tea, beans, sesame, tobacco, and silk. Iron and coal are found; the Tayeh iron mines are the largest in China. There are ore refineries and flour mills, and manufactures of iron and steel, cement, cotton, and cigarettes. The chief exports are fish, eggs, hides, timber, garden vegetables, oils, cotton, tea, and sesame.

Wuchang, located at the junction of the Han with the Yangtze, is the capital. Other important cities are Hankow, ICHANG, Hanyang, and SHASI. The principal industrial center of the Wuhan cities (HANKOW, HANYANG, WUCHANG) fell to the Japanese in October, 1938; Siangyang, strategic town on the Han River in northwest Hupeh was taken in May, 1939. The Chinese had recaptured most of the province by June, 1943.

K. E. H.

**HURD, PETER**, 1904–, American painter, was born in Roswell, N.M. A pupil of N. C. Wyeth, he married his teacher's daughter, Henriette, and later illustrated many of the books edited by his father-in-law, such as *Marauders of the Sea* (1935). Hurd also studied at the Pennsylvania Academy of Fine Arts. He is noted for his dramatic scenes of New Mexico which were painted for the most part at the studio on his ranch at San Patricio, N.M. Among these are "Fourth of July," "First Snow," and "El Mocho." Also a muralist he executed frescoes for the U.S. Post Office in Dallas and in Big Spring, Tex., and for the New Mexico Military Institute. James F. Cooper's *The Last of the Mohicans*, Mark Twain's *The Adven-*

*tures of Tom Sawyer*, and Cornelia Meigs' *Swift Rivers* (1937) are a few of the books that Hurd has illustrated.

**HURDY-GURDY**, a musical instrument from which the sound is obtained by the friction of strings of catgut or wire, stretched on a sounding board, the various notes being stopped by a simple apparatus of keys. In appearance it resembles the guitar and the lute. It has from four to six strings, two of which are carried direct to the tailpiece, and tuned in unison.



FRENCH EMBASSY INFORMATION DIV.

A French musician plays the hurdy-gurdy

The vibration of the strings is produced by a wooden wheel, which, being rosined, acts the part of a violin bow, and is turned by a handle at the end. A popular misconception has confused the term with the piano organ played by itinerant street peddlers.

**HURLEY, PATRICK JAY**, 1883–, American statesman, was born in Lehigh, Okla., and studied at Bacone College and at the law schools of National and George Washington universities. Admitted to the Oklahoma bar in 1908, he began practice in Tulsa; and from 1912 to 1917 was attorney for the Choctaw Nation. In World War I he served overseas, became a lieutenant colonel, and was cited for gallantry in action. As attorney for the U.S. Army of Occupation in Germany, he negotiated an agreement with the Duchy of Luxembourg. In 1929 he was appointed assistant secretary of war, and in November, 1929, became President Hoover's secretary of war, serving until 1933. During World War II, as brigadier general, he was sent by President Roosevelt to carry supplies to MacArthur's forces through the blockade of Bataan. He was U.S. minister to New Zealand (1942–43), President Roosevelt's "personal representative in the Near and Middle East" (1943–44), and ambassador to China (1944–45). He was defeated when he ran for U.S. senator from New Mexico in 1946 and in 1948.

**HURLEY**, city, N Wisconsin, county seat of Iron County, on the Montreal River, the Soo Line and the North Western railroads, and U.S. highways 2 and 51; adjacent to Ironwood, Mich. It was founded by M. A. Hurley in 1884 as an iron ore and lumber camp. Hurley's boom lumbering days served as a setting for Edna Ferber's *Come and Get It*. Today Hurley subsists largely as a shipping center for ore from both the Michigan and Wisconsin mines. Pop. (1950) 3,034.



## Huron

**HURON**, city, E South Dakota, county seat of Beadle County, on the James River, the North Western and the Great Northern railroads, U.S. Highway 14, and the Inland and the Mid-Continent air lines; about 120 miles E of Pierre. Huron, settled about 1880, is a trade center and a railroad divisional headquarters. It is the seat of Huron College and the scene of the annual South Dakota State Fair. Huron has railroad shops and manufactures packing house products, butter, and feed. Pop.(1950) 12,788.

**HURON COLLEGE.** See COLLEGES.

**HURON INDIANS**, a highly organized confederacy made up of four Iroquois tribes. When first known they were living around Georgian Bay of Ontario in some twenty or twenty-five villages with a population in excess of 20,000. They were at war with their Iroquois kinsmen in New York state and for purposes of protection surrounded part of their towns with single or double palisades. Agriculture was practiced by cutting away the forest and planting corn, beans, sunflowers and tobacco in hills. When the soil near to the towns became exhausted they were forced to move to near clearings. Social organization consisted of the family, clan, phratry, tribe and confederacy each with its council. Woman's power was very great especially in the selection and possible demotion of chiefs and other representatives. There was a well developed code of laws in which personal rights were protected. Religious life was characterized by elaborate ceremonies in which dancing and sacrifice were important. Superior beings which took an interest in the affairs of men were recognized but there was also a belief in widespread magic power—*orenda*—which permeated all things and made some objects the subject of veneration.

About 1650 they were defeated by the other Iroquois who had been supplied with guns by the Dutch. Many were killed and others were taken captive. The remnants fled to Michigan and Wisconsin; later they joined the Illinois, then living along the Mississippi River. Here they came into conflict with the Sioux and being unable to hold their own against such powerful foes they returned eastward. For a long time they were near Detroit, then on the White River in Indiana. Later they settled in the valley of the Ohio where they were known as Wyandot. In 1842 they moved to Kansas and in 1867 were placed on a reservation in northeastern Oklahoma.

FAY-COOPER COLE

**HURON, LAKE**, one of the Great Lakes of North America, traversed N and S by the boundary line between the United States and Canada. It is connected with Lake Superior on the northwest by the St. Marys River, and with Lake Erie on the south by the St. Clair and Detroit rivers. The Straits of Mackinac connect Lake Huron with Lake Michigan. It is second in size of the Great Lakes, with a water surface of 23,010 square miles (9,110 U.S.; 13,900 Canada), and a drainage basin of 72,600 square miles. The mean level of its surface above the sea is 581.13 feet. During the course of each year the normal level is subject to a consistent seasonal rise and fall, its lowest stages prevailing during the winter months and its highest stages during the summer months. Georgian Bay is a large arm on the northeast. The water of Lake Huron is cold and pure, and abounds in fish, the whitefish being the most important. Lake Huron is subject to violent storms. There are few harbors on the west side except Saginaw Bay. The largest group of islands in the lake is that of Grand Manitoulin belonging to Canada. See GREAT LAKES.

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**HURONIAN**, a name given by Sir William Logan to a series of rocks laid down in three periods of sedimentation during Proterozoic time in the Lake Superior region and in the area north of Lake Huron. The three systems are known as Lower, Middle, and Upper Huronian. Each of the three systems rests unconformably on the system below, and the Upper



MICHIGAN TOURIST COUNCIL

### Lake Huron with Blue Water Bridge in distance

Huronian unconformably underlies the KEWEENAWAN. The Huronians contain conglomerate, sandstone, and shale, although for the most part these have been metamorphosed into quartzite, slate, and schist. They also contain much igneous rock. In the Lake Superior region valuable deposits of iron ore are found in these rocks, particularly in those of the Middle and Upper Huronian formations, although some iron ore also occurs in the Lower. The Mesabi range, located a few miles from the western end of Lake Superior, contains the most important deposit of iron ore (HEMATITE) in the United States.

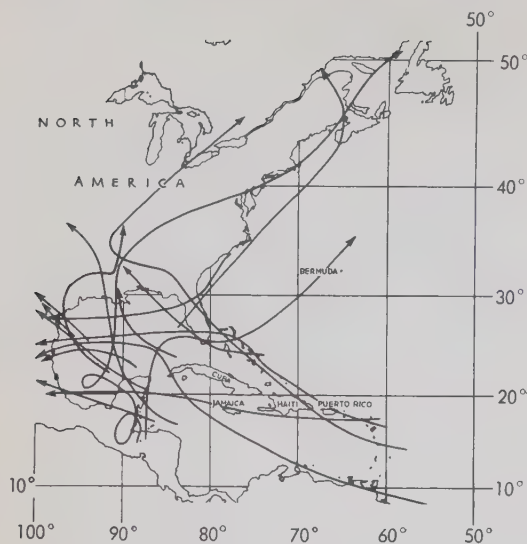
**HURRICANE**, a severe storm of wide extent developing in the West Indies during the late summer, and following a path nearly parabolic toward Florida or even the inner Gulf of Mexico, and then toward the northeast at an average speed of 20 to 30 miles per hour. Technically a *Tropical cyclone*, its severity may last into more northerly regions endangering shipping and coastal areas into New England.

The storm is circular or oval in form with a diameter of from 50 to 300 miles. The winds are counterclockwise, rather light on the outskirts, carrying light rain. Approaching the center or "eye" of the hurri-



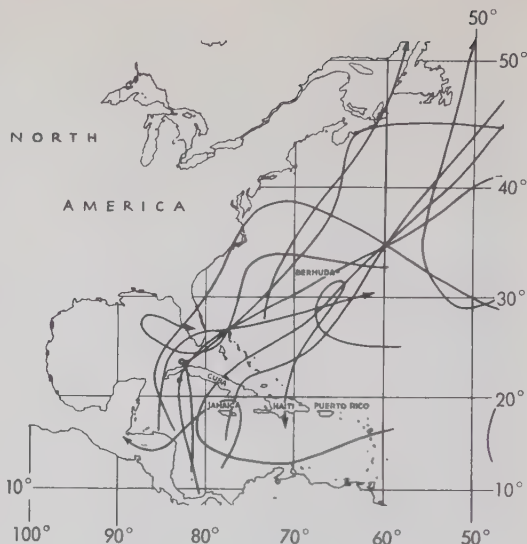
LIFE MAGAZINE

### Man and trees bow to fury of Florida hurricane



Tracks of June and July tropical cyclones

cane the wind and the rain increase, wind velocities reaching 100 miles per hour or more. In the "eye of the storm" the winds subside and the weather may be drizzly or even clear. But the seas are confused and mountainous. The barometer may drop to 28 inches (949 millibars) or lower. The passage of the storm's "eye" is deceptive. From the welcome calmness the wind increases violently and the hurricane is again in full force although passing. On the approach of the storm "hurricane warnings" are flown from the weather stations and given by radio. The path is forecast together with the rate of travel. Aviation and radio have been of great assistance in giving warnings



Tracks of October-November tropical cyclones

and in studying the varied character of hurricanes.

The actions of the hurricane of the West Indies and the typhoon of the China Sea are identical. The first, "hurricane," is derived from the Spanish "huracan." The second, "typhoon," derives from the Chinese "tai-fung" or "great wind." See BEAUFORT SCALE; CYCLONE; TYPHOON; WEATHER FORECASTING; WEATHER.

V. L. S.

**HURRICANE DISASTERS.** See STORM DISASTERS.

**HURST, FANNIE**, 1889–, American novelist, was born in Hamilton, Ohio. In 1912 she settled in New York, where she published her first fiction—four volumes of short stories, including *Humoresque* (1919), perennially popular in dramatic versions. Her most successful novels—*Lummock* (1923), *Appassionata* (1926), *Five and Ten* (1929) and *Back Street* (1930)—are sympathetic studies of modern women at various social levels. Her later novels include *Imitation of Life* (1933), *We Are Ten* (1937), *Hallelujah* (1944), and *The Hands of Veronica* (1947).

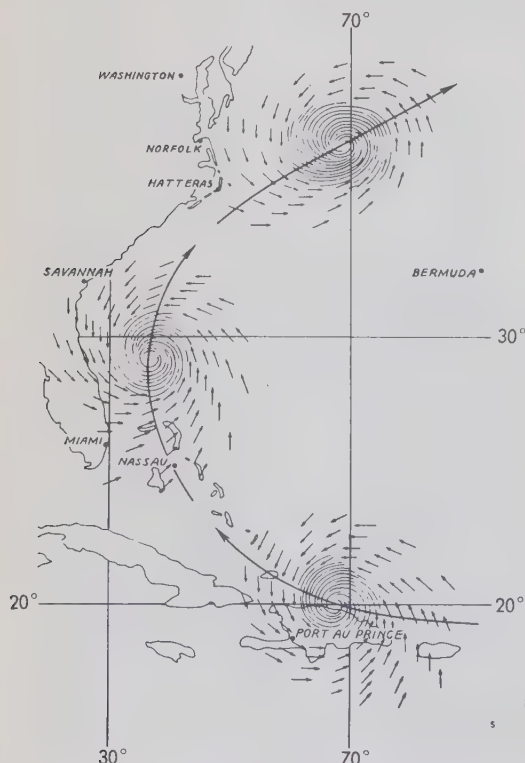


OGGIANO

Fannie Hurst

**HURST, JOHN FLETCHER**, 1834–1903, American Methodist Episcopal bishop, was ordained in the United States; became tutor of theology in the Mission Institute in Germany (1866–71); was professor (1871–73) and president (1873–80) of Drew Seminary, N.J. A bishop from 1880, he was the first chancellor of the American University at Washington, D.C.

**HÜRTGEN FOREST**, a wood in Germany, the scene of bitter winter fighting during World War II, following Aachen's capture by the U.S. First Army, which in November, 1944, pushed eastward south of Aachen. The fighting raged back and forth, the Germans resisting desperately, for the forest blocked the approaches to the Cologne and Ruhr areas. The Hürtgen terrain was composed of steep hills, thick woods, numerous creeks, and poor roads. The Germans had planted belts of mines and much booby-trapped barbed wire. Dug-in machine guns sprayed the whole area with interlocking fire. Artillery, doubly dangerous because of bursts in the trees, covered every objective. The weather brought constant rain, snow, and near-freezing temperatures. Living in water-filled holes, usually without blankets, troops



Track and wind system of West Indian hurricane



had no escape from cold and wet.

In the woods, German positions could not be detected more than five yards away. Yet enemy outposts could observe any approach and meet it by instant artillery and mortar fire. Tanks finally broke the wire, and infantry followed in their tracks after the armor had detonated mines.

In pushing forward a thousand yards, American forces suffered heavily during the first five days. The next enemy line was as strong as the first; the identical procedure had to be repeated. Another five days gained another mile. The Germans counterattacked daily. After every advance, men spent hours digging holes and cutting logs to cover them, with artillery shells bursting in the trees above them. One regiment on Nov. 22 reached the last strip of the forest. Three more days of vicious fighting cleared the area.

JOSEPH I. GREENE

**HUSBAND AND WIFE.** The term "husband and wife" describes persons connected by the marriage tie. A "spouse" is a legal wife or husband. Great changes have taken place in the legal rights of husbands and wives in modern times; the rights and powers of wives have been greatly expanded as to their personal actions and their property. Marriage is known as a form of contract, but differs from most contracts in that the dissolution of the marriage tie requires the consent of the state and in the fact that in most of the states a license and some form of ceremony is required to solemnize a marriage. Common law marriages, that is marriages created by the simple unsolemnized agreement of a man and woman to become husband and wife, are denied recognition in most states. Mutual consent on the part of the husband and wife is not sufficient for termination of the contract, and the state will not act to terminate the arrangement except for certain reasons set out in the state statutes.

**Personal Rights and Duties.** It is customary in this country for the wife to assume the surname of her husband upon marriage, although there is no legal obligation to do so. While formerly the wife took on the nationality of her husband, she now retains her own national status, and if she be a foreigner married to an American, she must be naturalized in order to become an American citizen. The marriage status carries with it certain personal rights and obligations between husband and wife which ordinarily continue for the duration of the marriage. The husband is ordinarily considered to be the head of the family and has the right to choose and establish a family domicile. His choice in this, however, must be consistent with the comfort, health, welfare, safety and peace of mind of his wife. Husband and wife are under duty to cohabit with each other, but except in Louisiana there is no legal process in this country by which cohabitation between the two may be enforced.

The husband is under duty to protect his wife and he is not privileged to inflict corporal punishment on her or to deprive her of her liberty or unreasonably to interfere with her religious beliefs. Both at common law and under most state statutes, the husband is bound to support his wife. This obligation attaches at the inception of the marriage and ordinarily continues as long as the relationship of husband and wife exists. The husband is required to furnish such support as is reasonable, considering his earning ability, means, situation and condition in life. Unless otherwise provided by statute, the wife is under no duty to support her husband. A wife is not responsible for a crime committed by her husband unless she participated in it with him, but if a wife commits a crime in the presence of her husband, except a crime of murder or treason, his command or coercion will be presumed. If a wife voluntarily joins with her husband in the commission of a crime, both are equally guilty and both may be jointly convicted.

**The Property Rights** of husband and wife vary greatly from state to state, but in a majority of the states both spouses must join in a deed of land owned

by either spouse in order for the purchaser to obtain clear title to the land. This may be due to the existence of **DOWER** rights (right of the wife in the land of her husband), **CURTESY** (right of the husband in the land of the wife), homestead rights (which prevent sale of the home unless both husband and wife consent), community property laws (which provide that property acquired during marriage other than by gift, will or descent is the property of both husband and wife), common law rules (which deny a wife the right to sell land without her husband's consent but which have been abrogated in most states) or the special provisions of local laws. With the exception of contracts for necessities and authorized or ratified contracts made by the wife as his agent, the husband is not bound by his wife's contracts. A husband is not ordinarily liable for debts contracted by his wife before marriage.

An antenuptial settlement is a contract which is entered into before but in contemplation and generally in consideration of marriage. It involves property or property rights and interests of the prospective husband and wife. Marriage settlements are regarded with favor as not being against public policy. Post-nuptial settlements fixing property rights between the spouses will ordinarily be upheld where there is no evidence of fraud present. By antenuptial and post-nuptial contracts, either spouse may surrender his or her property rights in the property of the other spouse.

When authorized by statute, husband and wife may contract with each other. The validity of deeds of land between them ordinarily is ascertained by the rules which determine the validity of other contracts. In most states a husband may make a deed conveying lands directly to his wife, but in a few states the rule is otherwise, since a deed must have two parties (the grantor and the grantee) and under the old rule a husband and wife are one person. Generally, a solvent husband may, under modern law, make a valid gift to his wife.

In some states the community property system operates. The general principles underlying the system is that all property acquired during marriage by the industry and labor of either the husband or the wife, or both, together with any increase in it, belongs beneficially to both during the continuance of the marriage. The system was borrowed from France and Spain and the states in which the system is in operation presently are Arizona, California, Idaho, Louisiana, New Mexico, Nevada, Texas, Washington, Oregon and, to a more limited extent, Oklahoma.

A personal injury to a married woman may give rise to two causes of action; one, for her personal pain and suffering, and the other for her husband's consequent loss of her services.

**Separation.** While the marriage relationship can be terminated only by death or divorce, a separation agreement is sometimes entered into by the husband and the wife. Ordinarily, this provides for the wife's support during the period of the separation. This is generally called a separation agreement. In some states the grounds which entitle the wife to such separate maintenance are specified by statute. Some states hold that grounds sufficient to obtain a divorce ordinarily must appear in order to entitle the wife to separate maintenance. In many states, a husband who abandons his wife and leaves her without adequate means of support may be prosecuted as for a criminal offense (see **DESERTION**). Except where it has been abolished by statute, a husband generally has a right of action for damages for the alienations of the affection of his wife. Under the Married Women's Enabling Acts generally a wife is also held to have the same right. See **MARRIAGE**; **DIVORCE**.

ROBERT KRATOVIL

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**HUSBANDRY.** See **ANIMAL HUSBANDRY**.

**HUSBANDRY, PATRONS OF.** See GRANGE, THE.

**HUSEIN IBN ALI**, 1856–1931, Arab chief, was sherif of Mecca (1908–16) when, during World War I, he was persecuted by Colonel Lawrence of Arabia to fight against the Turks. He was king of the new Arab state of Hejaz (1916–24). In 1924, proclaiming himself caliph, he was defeated by Ibn Saud of the Wahabis, and went into exile (see IBN SAUD).

**HUȘI**, town, NE Rumania, in the province of Moldavia, near the right bank of the Prut River, 65 miles SE of Iași (Jassy). Its name is derived from the Hussite colonists, reputed founders of the town in the fifteenth century. The seat of a Greek Orthodox bishop, Huși has a cathedral built (1491) by Stephen the Great of Moldavia. Vines and tobacco are cultivated nearby. The Peace of Prut was signed here in 1711 between Turkey and Russia, under Peter the Great. His forces, encircled in the marshes of the Prut by the Turks, were allowed to withdraw in exchange for the captured town of Asow and the demolition of Taganrog. Pop. 16,605.

**HUSS or HUS, JOHN**, 1369?–1415, Bohemian religious reformer, born in Husinec (from which his name is derived). While a student at the University of Prague, he became a follower of Wycliffe, with whose writings he had become familiar. In 1402 he was appointed rector of the university and began to preach in the native Bohemian, or Czech, tongue, becoming a popular preacher. A papal bull, issued in 1410, ordered the burning of Wycliffe's books, and Huss preached against the decree, thereby incurring the antagonism of the church which resulted in his own excommunication by the archbishop, Sbynko. When Huss continued his support of Wycliffe's doctrines and refused to go to Rome to answer the charges against him, the pope (John XXIII) placed his residence under interdict and finally even ordered his arrest. Huss left Prague in 1412 and went to Austri where he wrote his principal book, *De Ecclesia*.

In 1414 Huss was summoned to appear before the council which met at Constance, his safe-conduct being guaranteed by the emperor Sigismund. Huss went before the council and defended his views and the doctrines of Wycliffe, but three weeks after his arrival he was imprisoned, despite the promise of protection which the emperor had given. Huss refused to recant the doctrines which the council had declared heretical and would not submit unconditionally to the authority of the council. Accordingly, he was condemned to death as a heretic and burned at the stake, dying as bravely as he had lived and preached.

**HUSSITES**, followers of John Huss, leader of a movement centered in Bohemia that had both religious and political aspects. Huss and his followers protested corruption in the papal court and broke with the authority of Rome; as the movement developed, theological differences, notably about the Eucharist, also arose. The movement represented at the same time an antagonism of Bohemian against German. The execution of Huss following his condemnation by the Council of Constance in 1415 led to violent indignation in Bohemia and to attacks on churches and monasteries. In 1420 Pope Martin V proclaimed a crusade against the Hussites, and German armies endeavored not only to stamp out the sect as heretics, but to establish the authority of the emperor in Bohemia. In a succession of campaigns the Hussites, led first by John Zizka and later by Andrew Prokop, were victorious. Internal division, mainly theological, weakened them. The Taborites, an extreme wing, were defeated at Lipan in 1434, and a compromise was arranged with Emperor Sigismund in 1436 permitting the moderate, or Utraquist, form of the Hussite movement.

This settlement was generally maintained, despite efforts of the Hapsburgs to destroy it, until the Thirty Years' War. A number of Hussites accepted Lutheran and Calvinist doctrines; others were absorbed in the

Catholic population. Hussite influences were important in the development of the Moravian church and continued for centuries as a current of thought among Czechs both in Bohemia and abroad. See *BOHEMIA, History*; *MORAVIAN CHURCH*.

**HUTCHESON, FRANCIS**, 1694–1746, Irish philosopher, probably born in Drumalig. He taught in Dublin (1717–29) and was professor of philosophy at the University of Glasgow (1729–46). Hutcheson's philosophy is based largely upon the benevolent theory of moral conduct that gave rise to the formula "the greatest good for the greatest number," according to which benevolent behavior must not be judged in terms of the good that it brings to the doer, but rather in terms of the satisfaction derived from the performance of the act itself and the ultimate good that results from it. His works include *Inquiry into the Ideas of Beauty and Virtue* (1725), *Treatise on the Passions* (1728), and *System of Moral Philosophy* (2 vols. 1755). See UTILITARIANISM.

**HUTCHINS, ROBERT MAYNARD**, 1899– , American educator noted for his innovations in higher education. He was born in Brooklyn, N.Y., and graduated from Oberlin Academy in 1915. After two years at Oberlin College he served in an ambulance unit with the U.S. Army in 1917 and with the Italian Army in 1918–19. After the war Hutchins entered Yale University, graduated in 1921, and married Maude Phelps McVeigh. In 1923 he was appointed secretary of Yale but continued his law studies and received his degree in 1925. After graduation he taught law at Yale, became a full professor at 27, and dean of the Yale Law School in 1928.

In 1929, when he was only 30, he was inaugurated president of the University of Chicago. (See CHICAGO, UNIVERSITY OF.) By 1931 he had instituted the Chicago Plan which eliminated compulsory class attendance, reduced residence requirements, and largely substituted general courses and examinations for the traditional "credit" system. He introduced the Great Books courses in 1938 (see GREAT BOOKS), and, in 1942, his "New Plan," which awarded a bachelor's degree at the end of the sophomore year. He successfully steered the University of Chicago through the 1929 depression and World War II, and in spite of disapproval of his innovations, some other schools adopted them.

Hutchins advocated the study of the fundamental, the great ideas of the past; he organized the Great Books Foundation (1947), designed to make the classics widely available. Believing "One World" was the alternative to the threat of atomic destruction, he led in the formation of the World Constitution Committee (1945). He resigned as chancellor of the University of Chicago in 1951 to become associate director of the Ford Foundation, headed by Henry T. Heald. He wrote *No Friendly Voice* (1936), *The Higher Learning in America* (1936), and *Education for Freedom* (1943).

**HUTCHINS, THOMAS**, 1730–89, American geographer, born in Monmouth County, N.J. A British soldier, he was imprisoned in London for refusing to fight against the colonists. Released in 1780, he joined General Greene's southern army. Appointed geographer to the United States (1781–89), he was a Pennsylvania boundary commissioner and surveyor of the Northwest Territory.

**HUTCHINSON, ANNE MARBURY**, c. 1591–1643, American colonial religious theorist, was born in Alford, England, and emigrated to Massachusetts Bay Colony in 1634 with her husband, William Hutchinson. She began to hold religious meetings, in which she put forth theories of a "covenant of grace," a personal intuition of God's grace by which the individual might guide his conduct, instead of by the "covenant of works" dependent on the church and state. She was banished by Winthrop's government in 1637 for "trading the ministers and their ministry," and in 1638 cast out by the Boston church. She



settled in Aquidneck, R.I., moving to Long Island Sound after her husband's death (1642). She and part of her large family were massacred by Indians in 1643. See RHODE ISLAND, History.

**HUTCHINSON, THOMAS**, 1711–80, American colonial governor, was born in Boston. The great-great-grandson of ANNE HUTCHINSON, he entered Harvard at 12, was graduated in 1727, and earned his M.A. in 1730. While in college he carried on several private business ventures, and upon his graduation entered his father's firm. Both his father and grandfather had been members of the colonial council of Massachusetts, and in 1737 Hutchinson himself was named Boston selectman and in the same year was elected to the House of Representatives. Here he served, except for one year, until 1749, and for three years was speaker. During this period he went to England to represent Massachusetts in the boundary dispute with New Hampshire, and in the colony became known as a staunch supporter of a sound currency, a stand which helped incur the bitter enmity of Samuel Adams.

In 1749 Hutchinson became a member of the Council, in 1752 a judge of probate, and in 1758 lieutenant governor. Two years later, while still holding these offices, he was also appointed chief justice. Honest, able, and willing to serve, he wielded more political influence than any other man in Massachusetts. In 1763, however, with the outbreak of the dispute between Parliament and the colonies over taxation, Hutchinson's influence began to wane. Personally opposed to the Sugar and Stamp acts, he was recognized as the leader of the party upholding Parliament's authority and used his best endeavors to enforce the acts. This, plus the fact that his brother-in-law was stamp distributor, led to popular feeling against him, and in 1765 a mob destroyed his house, with all his valuable books, MSS, furniture, and plate. This act of vandalism made him more determined to carry out Parliament's policy. Hutchinson was acting governor (1769–71) and governor (1771–74). In this capacity he erred in judgment in stirring up controversy by asserting British authority, although popular feeling had died down by 1770. He thus played into the hands of the patriot propagandists, and by 1774 his position had so deteriorated that he left for England. There he remained until his death, spending most of his time in finishing his *History of the Colony of Massachusetts Bay*, an accurate, scholarly work that is still valuable.

One of the most capable men produced by colonial America, Hutchinson was a keen scholar and a capable administrator. He deeply loved America and New England, especially Massachusetts, but his chief loyalty was to the crown, and he regarded the difficulties between mother country and colonies as artificially created by a small band of dissidents. H. L. H.

**BIBLIOG.**—*Dictionary of American Biography*; E. A. Jones, *The Loyalists of Massachusetts* (1930); A. C. McLaughlin, *A Constitutional History of the United States* (1935).

**HUTCHINSON**, city, central Kansas, county seat of Reno County, on the N bank of the Arkansas River; the Santa Fe, the Rock Island, and the Missouri Pacific railroads; U.S. Highway 50; and the Continental Air Lines; about 40 miles NW of Wichita. Hutchinson, the fourth largest city in Kansas, was laid out in 1872 and named for its founder, C. C. Hutchinson. Built upon salt deposits, reputedly among the richest in the country, Hutchinson's chief industry is the mining, processing, and shipment of salt. Hutchinson is situated in the most important wheat-producing area of Kansas; wheat shipping and storage is its second most important industry. The city is surrounded by oil fields and is adjacent to Kansas' most productive gas well. During World War II a U.S. Navy Air Base was located near the city. Pop. (1950) 33,575.

**HUTCHINSON FAMILY**, a group of American singers which toured the United States from the 1840's through the first 10 years of the 20th century. The four brothers—Asa, Jesse, John, Judson—and

their sister Abby were the first native troubadours to organize and travel through the nation and they became an important influence in 19th century American society. Many of their songs were pure entertainment, but they also performed powerful reform ballads commenting on abolition, temperance, suffrage, and dress reform. During their tours the group founded the town of Hutchinson, Minn., and in 1862 they sang for Abraham Lincoln in the White House.

**HUTSON, DON**, 1913–, American football player, was born in Pine Bluff, Ark., and graduated from the University of Alabama where he was an All-American end in 1934. He later played professional football with the Green Bay Packers and acquired a reputation as the greatest forward pass receiver of all time. An all-professional end nine years (1936, 1938–45), he was the National League's leading pass receiver (1936–37, 1939–45), leading scorer (1940–44), and most valuable player (1941–42).

**HUTTEN, ULRICH VON**, 1488–1523, German scholar, was born in the castle of Steckelberg, near Fulda. He was placed in the monastery of Fulda when he was only 11 years old but escaped in 1505, and lived the life of a wandering scholar, visiting the chief universities of Northern Germany and spending some time in Italy. In 1517 he settled in Germany, devoting his time and energy to free that country from the dominance of Roman Catholicism. For his poetical achievements, that same year, the Emperor Maximilian crowned him poet laureate. At length his outspoken and at times virulent criticism of the Roman Catholic hierarchy, and his support of the humanist Reuchlin in his long struggle against the Dominicans, led to Hutten's extradition; he found a shelter in the Ebernburg, near Kreuznach, and soon became as noteworthy a champion of the Reformation as he had been a zealous humanist. Later he went to Zürich, where he was cared for by Zwingli until his death. Hutten's early writings were all in Latin. Of his works, the best known are the *Dialogues*, some of which he translated into German (1521). His complete works were published by Böcking (1859–70).

**HUXLEY, ALDOUS**, 1894–, English writer, was born in Godalming. The grandson of THOMAS



ROSENY'S

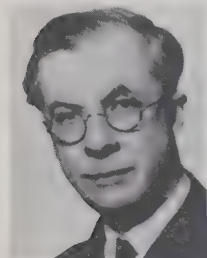
Aldous Huxley

HENRY HUXLEY and the brother of the modern biologist, JULIAN HUXLEY, Aldous Huxley is perhaps the most brilliant member of a brilliant family. At least since 1920, when his witty and disillusioned volume of poetry, *Leda*, appeared, he has been in fiction, essay, and verse the most learned and scintillating anticipator and reflector of many of the most advanced and sophisticated currents in modern thought. Moving from the negativism of such novels as *Crome Yellow* (1921) and *Antic Hay* (1923) through the more positive humanism of *Point Counter Point* (1928), he has become the most intelligent defender of a return to mystical religion in his best-seller, *Time Must Have a Stop* (1944). The philosophic basis of his shifting position is best revealed in *On the Margin* (1923), *Do What You Will* (1929), *Ends and Means* (1937), *Ape and Essence* (1949).

HARVEY CURTIS WEBSTER  
**HUXLEY, JULIAN SORELL**, 1887–, English biologist and writer, was born in London and studied at Eton and Balliol College, Oxford. The brother of ALDOUS HUXLEY and the grandson of THOMAS HENRY HUXLEY, he inherited and extended the two distinctions of his family, science and literature. After lecturing in zoology at Balliol College (1910–12), he came to the United States where he was research associate at Rice Institute (1912–13) and assistant professor (1913–16). He returned to Oxford in 1919 as fellow of New College and senior demon-

strator in zoology; was professor of zoology at King's College, London (1925-27), and an honorary lecturer (1927-35). He also held the Fullerian chair of physiology in the Royal Institution

(1926-29). Huxley was a prolific scientific writer, displaying a lucid prose quality in *Essays of a Biologist* (1923), *The Stream of Life* (1926), *Ants* (1929), *Bird-Watching and Bird Behavior* (1930), *Problems of Relative Growth* (1932), *Scientific Research and Social Needs* (1934), *The Uniqueness of Man* (1941), and *Evolution, The Modern Synthesis* (1942). He also collaborated in writing *Animal Biology* (with J. B. S. Hal-



HARPER BROS.

Julian Huxley

dane, 1927), *The Science of Life* (with H. G. and G. P. Wells, 1929), *An Introduction to Science* (with E. N. da Costa Andrade, 4 vols. 1931-35), *The Elements of Experimental Embryology* (with G. R. De Beer, 1934), and *We Europeans: A Survey of Racial Problems* (with A. C. Haddon, 1935). As general supervisor of biological films for Zoological Film Productions, Ltd. (1937-39) he used motion pictures to spread scientific knowledge. He was director general of the UN Educational, Scientific, and Cultural Organization (1946-48). He wrote *UNESCO: Its Purpose and Its Philosophy* (under the pseudonym Balbus, 1947); *Soviet Genetics versus World Science* (1949).

M. E. C.

**HUXLEY, THOMAS HENRY**, 1825-95, English man of science, an earnest advocate of the doctrine of evolution, was born in Ealing, Middlesex. He studied medicine and in 1846 was appointed assistant surgeon to H.M.S. *Rattlesnake*, then about to proceed on an exploring expedition to the coast of New Guinea and the Barrier Reef of Australia. During the voyage (1848) he wrote and sent home for publication his paper "On the Anatomy and Affinities of the Family of the Medusae," which contained extremely important scientific data. In 1854, after adversity, he succeeded Professor Forbes at the Government School of Mines in Jermyn Street, London, a position in which he passed most of his life, though he also held the appointments of Hunterian professor at the Royal College of Surgeons (1863-69), Fullerian professor at the Royal Institution (1863-67) and many other posts of honor. In 1876 he went to America where he lectured on evolution and other biological subjects.

Huxley's *Scientific Memoirs* were republished in four volumes by Sir Michael Foster and Prof. Ray Lankester (1898; suppl. vol. 1903); and his collected essays, some of them theological and containing his brief but charming autobiography, were republished in nine volumes in 1893-94. It is by many of these essays and controversial papers that Huxley is best known popularly. Of his text books, many, such as *Lessons in Elementary Physiology*, *Physiography*, *Anatomy of Vertebrated and Invertebrated Animals*, are models of clarity and accuracy. He gave his life to the promulgation of what he regarded as truth, and strove primarily to inspire others, rather than to win laurels for himself. As a man his most distinguishing characteristic was his passion for "absolute veracity."

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**HUYGENS, CHRISTIAN**, 1629-95, Dutch scientist, son of CONSTANTIJN HUYGENS, was born in The Hague. He studied at Leiden, then, with his brother,



CHICAGO HIST. SOC.

Thomas Huxley



BAUSCH &amp; LOMB

**Christian Huygens** is portrayed explaining to Louis XIV, in 1678, his new wave theory of light

developed new methods of grinding telescope lenses. With his improved instruments he discovered the rings and a satellite of Saturn. In 1656 he invented the clock pendulum, and in 1673 published his *Horologium Oscillatorium*, in which he determined the correct laws of the pendulum, and developed theorems on centrifugal force which prepared the way for Newton. In 1669 he stated the laws of the collision of elastic bodies. In later life he constructed several remarkable lenses and telescopes. Huygens' immortality, however, rests on his development of the wave theory of light, which he first stated in 1678 in his *Traité de la Lumière* (pub. 1690). By the *Huygens Principle* he assumed that every point on a wave front of light is a new source of wavelets and propagates an indefinite number of wave fronts. In 1663, Huygens was elected to the British Royal Society.

**HUYGENS, CONSTANTIJN**, 1596-1687, Dutch poet, was born in The Hague. After an intensive education in the liberal arts, which developed his varied talents as versifier, gymnast, artist, and lutanist, he became a diplomatic agent, serving his country for 60 years. He was a member of Dutch legations in France, Venice, and in England, where he formed a life-long friendship with the poet John Donne. His works include *Batava Tempa* (1621); *Dagwerck. Hofwijck* (1653); and *Korenbloemen* ("Corn Flowers"), a collection of lyrics which he constantly polished and revised, publishing the first edition in 1658, and the last in 1672. Remarkably facile in technique, he was more sensitive to poetic form than most of his contemporaries. CHRISTIAN HUYGENS was his son.

**HUYSMANS, CORNELIUS**, 1648-1727, Flemish painter, was born in Antwerp. He achieved recognition for his landscapes, executed in vivid hues and indicating the mingled influences of Roman and Flemish masters. He tried portrait painting with less success, and sometimes essayed religious themes, as in "Christ on the Road to Emmaus," one of his best known works.

**HUYSMANS, JORIS KARL**, 1848-1907, French novelist, was born in Paris. After completing a course in law, he entered the ministry of the interior, working for 30 years as a civil servant. For a time he was associated with Zola and the Médan group, and many of his early novels, as *Marthe* (1876), *Les sœurs Vatar* (1879), and *À vau-l'eau* (1882), deal with prostitution and other forms of degradation. *A rebours* (1884) and *Là-bas* (1891) were morbid, impressionistic studies of decadence and diabolism in which he attempted a



"supernatural realism." In 1892 he was reconverted to Catholicism and made frequent retreats in the Benedictine monasteries of Igny and Ligugé. He renounced his satanistic novels and turned to devotional themes, but retained his naturalistic style and his characteristic sensuous vision. *En route* (1895), *La cathédrale* (1898), *L'oblat* (1903), and *Les foules de Lourdes* (1905) composed a powerful tetralogy devoted to his religious experience. Notable among his other works are *L'art moderne* (1883) and *Certains* (1889), in which he appears as one of the most discerning critics of the art of the Impressionists.

**HUYSUM, JAN VAN**, 1682–1749, Dutch painter, was born in Amsterdam. He studied under his father and first devoted his attention to landscape painting, later turning to fruit and flowers, of which he became one of the greatest painters. His pictures are remarkable for minute detail, brilliant coloring, and truth to nature.

**HVAR** Italian *Lesina*, an island, Yugoslavia, forming a part of Dalmatia, situated in the Adriatic Sea, between the islands of Brač and Korčula; area 120 sq. mi.; pop. about 3,500. It is more than 42 miles long and from two to five miles wide, and is traversed by a calcareous mountain chain. Because of the mild and healthful climate, the island is a popular health and bathing resort. The mild climate also lends itself to the cultivation of oranges, grapes, olives, locust beans, and figs. The manufacture of rosemary essence, stone quarrying, and fishing are important industries. Interesting features of Hvar, the capital, include a loggia (1540), which is now a casino; a cathedral; a Franciscan monastery, containing Rosselli's "Last Supper"; an arsenal; and several beautiful Venetian buildings. It is the seat of a Roman Catholic bishopric. Stari Grad (Cittavecchia) is a busy seaport and the most densely populated locality on the island.

In ancient times the island was known as Neos Pharos. Hvar was originally the site of the ancient Greek colony of Pharos, established about 390 B.C. The island was under Venetian rule from 1420 to 1797, when it was taken over by Austria. The Italians held it for a brief period following the collapse of the Austro-Hungarian Empire in 1918. In 1920 it was formally incorporated into Yugoslavia, and during World War II it was again held by the Italians.

**HVEN.** See **VEN.**

**HWA SHAN**, or **Hua Shan**, sacred mountain, central China, in Shensi Province, an isolated N spur, covering about nine square miles, of the Chin Ling (Tsin Ling) range, which is a far eastward extension of the great Kun Lun (Kuen Lun) Mountains; it rises about 7,000 feet above sea level. Hwa Shan stands just south of the southeast end of the great bend of the Hwang Ho (Yellow River) and close to the famous mountain fortress town of Tungkwan; a short distance west is the noted Communist city of Siking (Sian). Hwa Shan is divided into numerous peaks, some with razor edge summits; notably Pei Feng (north), Nan Feng (south) and Hsi Feng (west). It is first mentioned in the traditions of 2250 B.C., when it was one of the four sacred mountains of China; it is one of the nine of the present day. It became a center of Taoism with the inception of that religion some 20 centuries ago. Many legends cluster about the mountain, and ancient temples are perched here and there on its peaks in almost inaccessible places, some reached by giant steps cut in the rock. There are tremendous precipices, one with a sheer face dropping about 2,500 feet. Pine trees grow to the tops of the peaks.

**HWAINING**, or **Anking**, city, China, capital of Anhwei Province, on the Yangtze River, between Hangchow and Hankow; 160 miles SW of Nanking. It has trade in gold, silver, copper, salt, green tea, ink, and varnish. Pop. (1945 est.) 85,000.

**HWAIYANG**, or **Chenchow**, city, China, N central Honan Province, at the strategic junction of the north-south Peiping-Hankow Railway, and the east-

west Lunghai Railway. It is a trading center for rice, wool, and cotton. During World War II, Hwaiyang was China's advance military base in the north. Japanese troops occupied it on Apr. 22, 1945, but on September 18, Hwaiyang was designated the place for the surrender to the Chinese of all Japanese forces in that area. Pop. (1947 est.) 475,000.

**HWANG HO**, also **Hoang**, **Huang**, or **Yellow River**, second largest and most northerly of China's great rivers, rises at an altitude of 15,700 feet, W of Lake Tsaring (Kyaring) and N of one of the sources of the Yangtze in the Kun (Kuen) Lun Mountains of E Tsinghai Province, and flows E to curve in a great bend N and E through Inner Mongolia and then S to Tungkwan in Shensi Province, where it turns E and NE and empties into the Po Hai (Gulf of Chihli); total length, 2,700 miles. The river is a torrential mountain stream 75 yards wide in its early course. East of Lamato, the first town on the course of the river, the great caravan road to Lhasa crosses the Hwang through the pass of Chabubrun. After flowing through Lake Ngoring the river turns southeast through the deep gorges of the Amne Machin Mountains. Making a small loop across the northwest tip of the province of Szechwan, the Hwang bends northwest, north, and northeast through Tsinghai Province to enter Kansu Province. A few miles above Lanchow (Kaolan) in Kansu Province, the river receives its first sizable tributaries, the Sining and Pingfan. From Lanchow it winds northeast, picking up the Tsuli at Tsingyan and the Tsingshui at Chungning. After it crosses the Great Wall at Kingtai the Hwang broadens to a width of half a mile, the current slowing as the river crosses the southeast tip of Ningsia Province. At Chungning, in Ningsia, the Hwang turns north to



Change in course of the Hwang Ho

describe a huge arc through the sands of Ordos on the southern border of the Great Gobi Desert. In the course of this curve the river passes Ningsia, chief city of the province, enters Suiyuan Province at Linho, and turns south again at Paotow, in Suiyuan. At Hoku the river begins to form the boundary line between Shensi and Shansi provinces; along this southward course it receives many short streams, as well as the Yulin at Tsingkien, the Yen at Taning, and the principal tributaries of the Hwang: the Fen at Hotsin and the Wei at Tungkwan, in Shensi Province. Here the Hwang again turns east and enters Honan Province. In the region of Kaifeng, the river turns sharply northeast, crosses the southern tip of Hopeh Province and the Grand Canal in Shantung Province, and empties into the Po Hai.

The Hwang, one of the mightiest rivers of the world, drains a basin of 600,000 square miles, its flow varying from 10,000 cubic feet per second at low water stages to 38,000 cubic feet per second at flood time. Although it develops considerable potential water power as it passes through mountain valleys and deep gorges, the river has not yet been harnessed. On the plateau of the northwest it has cut deep valleys in the yellow loess which gives

the river its name, and plunges through almost vertical cliffs. As it enters the delta, or the Yellow Plain, the river drops but a foot per mile and is loaded with silt. Navigation by steamship is impossible throughout the entire course of the river, and only a few sections are deep or safe enough for launches or junks.

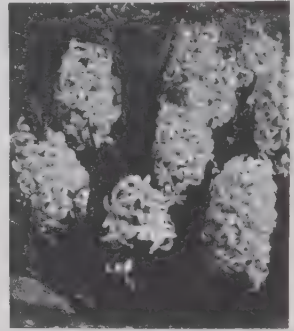
**History.** Through the centuries the flood waters of the Hwang have destroyed untold millions of lives and millions of tons of crops and have caused the river to be known as "China's Sorrow." Its floods and shifting course have built up much of China's Great Plain, filling in arms of the Yellow Sea with level farm land. As soon as the Hwang covered one section with loess from the inland hills and other silt from as far away as the mountains of Tibet, it shifted to fill other land. The river's silt load at times runs as high as 40 per cent by weight. In the past this accumulation has been confined between dikes of mud and straw, sometimes faced with masonry, elevating the river above the level of the countryside. These embankments imposed only a temporary check on the river's ravages. The most disastrous flood of modern times was in 1931, when the Yangtze, the Hwai, and the Hwang became one river, affecting the safety of the population and crops of 16 provinces.

Within the last 4,000 years the Hwang has changed its course seven times, and breaches have occurred no less than 1,580 times. From 1191 to 1852 the Hwang joined the Hwai and entered the Yellow Sea south of Shantung. In 1852 it parted company with the Hwai to return of its own accord to its original course, until in 1938 the Chinese opened the dikes just west of Kaifeng, 400 miles from the mouth of the Hwang, as a desperate measure to stop the invading Japanese armies. The river changed its course to usurp the channel of the Hwai once again, and the Yellow Sea received its flood of muddy waters. About 500 square miles of territory were thus saved from the enemy. In 1945, following the close of World War II, the attempt to control the Hwang and force it to return to its old course was again made. The work was done by the United Nations Relief and Rehabilitation Administration, under the direction of the United States Army Engineers and the United States Reclamation Bureau, in co-operation with the Chinese National Relief and Rehabilitation Administration, working with the Chinese National Conservancy Commission, the Yellow River Conservancy Commission, the Chinese Nationalist government, and the Chinese Communists. About 200,000 coolies working in day and night shifts built mammoth dikes of rock, Mississippi flood mats, and Douglas fir pilings. The last dike was closed in February, 1947, and the Hwang returned to its prewar course, discharging into the

Po Hai. Millions of acres of fertile land have thus been restored to the Chinese farmers of Honan, Anhwei, and Kiangsu. K. E. H.

**HWANGPOO.** See WHANGPOO.

**HYACINTH**, a genus of bulbous plants belonging to the family *Liliaceae*. They are popular hardy spring flowering **BULBS**, with radical leaves and fragrant blossoms, pink, blue, purple or white, arranged in racemes. There are some 30 species. The common hyacinth is *H. orientalis* and its numerous varieties, specially valued by gardeners. Hyacinths are extensively used in spring bedding, a light soil being preferred. About eight inches should be allowed from bulb to bulb, and the bulb should be planted in October, about five inches deep. Good bulbs are compact and heavy. They are easily forced if placed on the surface of pots of rich fibry compost and slightly pressed down in the soil, the whole being covered with ashes. As soon as the bulbs have become well-rooted, the pots should be placed in warmth, and water liberally supplied. For very early forcing, the most desirable variety is the so-called Roman hyacinth (*H. o. albulus*), a variety of French extraction which produces several small flower spikes instead of one large one. Hyacinths of all kinds are extensively cultivated near Haarlem, in Holland.



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**Hyacinths in bloom**

The water hyacinth is a member of the Pickerel-weed family, *Pontederiaceae*, and the genus *Eichhornia*, Kunth. The species *E. crassipes*, is naturalized in the streams and ponds of the southern United States. It floats on the surface, having inflated petioles and upright racemes of lavender flowers, and occurs in such masses as to seriously impede navigation.

**HYACINTH**, or **JACINTH**, a yellow, orange, red, or brownish variety of **ZIRCON**. It is composed of zirconium silicate, has a specific gravity of 4.65-4.71, and a hardness of 7½. The mineral is obtained in Ceylon, but it also occurs in various igneous and crystalline rocks in Bohemia, Norway, Greenland, Germany, and the Ural Mountains. In ancient times these stones were greatly valued, and though very hard, were cut into fine intaglios. Many of the stones are very beautiful and have a fine luster. Much of what is sold as hyacinth is really cinnamon stone **GARNET**, or **essonite**.

**HYACINTHUS**, in Greek legend, was the son of the Spartan king Amyclas, and famous for his beauty. He was passionately loved by **APOLLO**, who while engaging in a game of quoits with him accidentally struck and killed him. From his blood there sprang the hyacinth flower, which is probably not the modern hyacinth, but a species of iris or larkspur. His festival, the Hyacinthia, was one of the chief religious celebrations of the Spartans.

**HYADES**, the V-shaped group of seven stars, in the **CONSTELLATION Taurus**, to which the ancient Greeks gave the name "the Rainers" because they were thought to portend wet weather when they rose with the sun at the end of May. With the brilliant first **MAGNITUDE** star Aldebaran at their eastern tip, they are conspicuous in the winter sky, coming to the meridian at 9 P.M. about January 10, and at 10 P.M. about two weeks earlier. The Hyades moving **CLUSTER**, more than 33 **LIGHT-YEARS** in diameter and only 130 light-years distant, is the nearest of the open clusters; its 100 or more member stars do not include the ruddy Aldebaran.



EWING GALLOWAY

**Waters of Hwang Ho pour through last gap in dike as workers complete the mending of a 200-mile break**



**HYAENODON**, a genus of fossil carnivorous animals, belonging to the creodonts, about the size of a leopard. Its body was long and slender, the legs short, and each foot had five toes. The teeth, 44 in number, were of canine type. Its remains have been found in the Oligocene of Europe and America.

**HYATT, JOHN WESLEY**, 1837–1920, American inventor, was born in Starkey, N.Y., and attended Eddytown Seminary. Becoming a printer at the age of 16, he followed this trade in various towns in Illinois and New York for the next 15 years. In 1865 he decided to compete for the prize of \$10,000 offered by Phelan and Collander to the person who discovered a suitable cheap substitute for the expensive imported ivory used in making billiard balls. His efforts were successful in 1869 when he found that a mixture of nitrocellulose, alcohol, and camphor could be formed into a soft kneadable mass by heat and pressure. This mass was shaped into billiard balls in special molds and on being exposed to the cool air hardened into the first **PLASTIC—celluloid**. Hyatt designed special machinery for the manufacture of various celluloid articles and with his brother Isaiah established a celluloid factory in Newark, N.J. (1872). His other inventions included bonsilate (1878), containing bone and silica and used in the manufacture of buttons, billiard balls, and knife handles; a water-purifying machine (1881); a sewing machine (1900) capable of taking 50 lock stitches at once; and a sugar-cane mill (1901) which extracted a very high percentage of the juice from sugar cane.

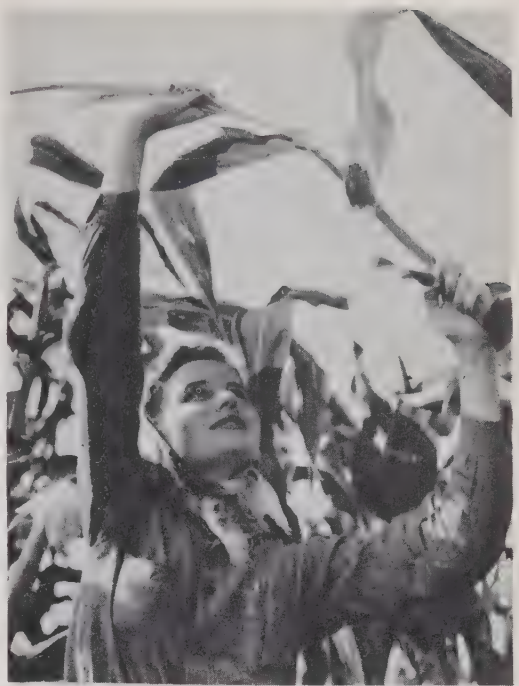
**HYATTSVILLE**, town, W central Maryland, Prince Georges County; on the Baltimore and Ohio Railroad and U.S. highways 1 and 50, about seven miles NE of Washington in a truck and fruitgrowing region. The town, incorporated in 1880, was named for its first postmaster. Many of the Hyattsville residents work in Washington, D.C. Pop. (1950) 12,308.

**HYATY**, town, SW Paraguay, in Guariá Department; on a railroad between Villarrica and Asunción, in the mountain foothills. Hyaty is a market town. Pop. (1944 est.) 15,000.

**HYBLA**, the name of three ancient towns of Sicily. Hybla, or Geleatis, was situated on the southern slope of Mount Etna, 16 miles north of Catania, where Paterno now stands. Here many Sicel and Roman remains have been found. Hybla Minor was known also as Megara, because it was colonized by citizens of the ancient Greek town of Megara; it is 40 miles from Augusta. Hybla Heraea was located on the road from Syracuse to Agrigentum. One of these towns—it is contested which one—was famous for the production of the Hyblaean honey, much celebrated in Greek poetry.

**HYBRID**, a plant or animal which is the offspring of parents of different species or of different varieties of the same species. The breeding of one species or variety with another is called hybridization or crossing. A mule is a hybrid between the domesticated horse, *Equus caballus*, and the ass, *E. asinus*. This cross is an unusual one among animals because it is a cross between two species. Most animal hybrids are the offspring of parents of different varieties within the same species, as, for example, the crossing of two varieties of cattle with each other, or of two varieties of dogs. In plants, hybrids may be produced by crossing two closely related species, but often such hybrids are sterile and produce no seeds. More often, plant hybrids are produced by crossing two-varieties of wheat, two varieties of apples, etc.

Hybridization in animals is accomplished by breeding a male of one variety (or species) with a female of another. Thus in producing a mule, a male ass is usually bred with a female horse. In plants, pollen of one variety (or species) is placed on the stigmas of another variety (or species). In order to prevent self-pollination and thus to ensure crossing in flowers, it is necessary to remove the pollen-bearing organs (sta-



FUNK BROS. SEED CO.

**Tassel of corn is removed for cross-breeding**

mens) from the flower that is to receive the pollen before those organs shed their pollen. The stigmas of de-staminated flowers are then pollinated with pollen of the other variety, and the flower is enclosed by a bag to prevent accidental pollination by wind or insects. As a result of this cross-pollination, the pollinated flower produces seeds that grow into hybrid plants. Hybridization is a technique used by plant breeders and animal breeders to develop new types of plants and animals. Through crossing, desirable traits which occur separately in two varieties may be brought together in the hybrid plant or animal resulting from the cross. Many of our better types of domesticated animals, fruits, ornamental plants, and field crops are hybrids.

Hybrids, since they are derived from differing parents and since they contain hereditary determiners from both, do not "breed true"; that is, their offspring are not all like their hybrid parents, but some re-



FUNK BROS. SEED CO.

**Hybrid Corn**, center, was produced by crossing the inbred variety at left with that at the right

semble their grandparents or other ancestors. In plant breeding, hybrids are usually propagated by grafting or by cuttings since such vegetative propagation maintains the hybrid type without change. If seeds of a hybrid plant are sown, some of the seeds grow into plants like the hybrid, while others develop into plants like the grandparents. Hybrids, both plant and animal, are sometimes sterile, that is, they are incapable of reproduction.

An interesting phase of hybridization is the great vigor often exhibited by hybrids. Thus hybrids are often larger and stronger than their parents, and often are more resistant to disease and more productive in crop yields. This superiority of many hybrids over their parents is called *hybrid vigor*. The causes of hybrid vigor are not well understood. Hybridization occurs rather commonly in nature, as a result of the interbreeding of two animals or two plants of different, closely related species, or, more often, of varieties within the same species. See BREEDING; HEREDITY; BURBANK, LUTHER. H. J. FULLER

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**HYDASPES.** See JHELMUM RIVER.

**HYDATID CYST.** See TAPEWORM.

**HYDE, ARTHUR MASTICK,** 1877–1947, American lawyer and statesman, was born in Princeton, Mo. After studying at the University of Michigan and the University of Iowa Law School, he practiced in his native town, and was mayor (1908–10). He was governor of Missouri from 1921 to 1925, and President Hoover's secretary of agriculture 1929 to 1933.

**HYDE, DOUGLAS,** 1860–1949, Irish folklorist and poet, was born in Frenchpark, county Roscommon. He was graduated from Trinity College, Dublin (1884), rapidly took rank as a scholar and was interim professor of modern languages at the University of New Brunswick (1891). He became president of the Gaelic League in 1893, and was president of other societies connected with the new Irish literary movement. In the same year he published *Love Songs of Connacht* and in 1899 his *Literary History of Ireland* appeared. He wrote several short plays in Gaelic and in 1906 visited the United States in the interest of the Gaelic League. He was professor of Modern Irish in the National University from 1909 to 1932 and in 1925 became editor of *Lia Fail*. In the same year, he entered politics as senator in the Irish Free State and served as president of Eire from 1938 to 1945. He was a popular cultural leader rather than a political figure, and his administration was supported by both Catholic and Protestant factions.

**HYDE, EDWARD.** See CLARENDON.

**HYDE, EDWARD,** 3rd EARL OF CLARENDON. See CORNBURY.

**HYDE,** market town and municipal borough, W central England, Cheshire, on the Tame River; seven miles E of Manchester. It has cotton spinning and weaving industries, a margarine plant, engineering works, iron foundries, and a felt hat factory. In the vicinity are coal mines. Pop. (1951) 31,498.

**HYDE PARK,** one of the best known of the parks in London, England; area, 361 acres. With Kensington Gardens on the west, Green Park on the east, and St. James Park on the southeast, Hyde Park affords a scenic three-mile walk. Originally belonging to the monks of Westminster Abbey, it was made into a royal deer park by Henry VIII in 1509. At the time of the Stuarts, Hyde Park had a race track. The first Great International Exhibition was held there in 1851 in the Crystal Palace. Features in Hyde Park today are Rotten Row, a fashionable bridle path; the Serpentine, a bathing lake and beach ordered by Queen Caroline in 1733; and the Marble Arch, a meeting place for "free-speech" orators.

**HYDE PARK.** See HOME OF FRANKLIN D. ROOSEVELT NATIONAL HISTORIC SITE.

**HYDER, or HAIDAR, ALI,** 1728–82, Mohammedan prince of India. His grandfather was a fakir; his father, a constable. In 1749, his bravery at a siege attracted the notice of the maharajah of Mysore, and he soon became ruler of the kingdom in all but name. After dispossessing his master (1759), he conquered Calicut, Bednor, Kananur, and other states; in 1766 his dominions included more than 84,000 square miles. Successful in his first campaign against the British (1767–69), he signed a treaty which provided for an alliance. When he was defeated by the Mahrattas (1772), he claimed English support, and on its refusal became their bitter enemy. Taking advantage of the war between the English and French (1778), he and his son, Tipu Sahib, descended into the Carnatic, routed two English commanders, and ravaged the country. His campaign came to an end when he was defeated in three battles by Sir Eyre Coote.

**HYDERABAD,** a former feudatory state, India, the largest in habitable area and population of the former Indian states, bounded on the N by Berar and the Central Provinces, on the E by the Eastern States and Madras Province, on the S by Madras, and on the W by Bombay Province; area 82,313 sq. mi.; pop. (1941) 16,338,534, including a minority of Moslems and a majority of Hindus. Berar, formerly a part of Hyderabad, during the British era was leased to the British and attached to Central Provinces for administration. See CENTRAL PROVINCES AND BERAR.

Hyderabad is a part of the great Deccan territory, and has both mountainous and level surfaces. It can be divided geographically and ethnically into two divisions, each named for the language of its people: Telingana and Marathwara. The open country is made up of vast fertile plains, not all of which are cultivated, some sterile tracts, and low rolling hills. The mountains are deeply wooded and picturesque. The state is well drained through its rivers and has many irrigation projects. The principal rivers are the GODAVARI, the Dudna, the Manjira, the Pran-hita, the Wardha, the Penganga, and the KISTNA. The climate is healthful.

**Industry and Transportation.** The principal occupation is agriculture; millets, rice, wheat, oil seeds, cotton, tobacco, fruits, and garden produce are raised. Some lac, gums, and oils are found, and raw and tanned hides are important articles of trade. There are cotton processing and weaving industries and flour mills. The chief exports are cotton, oil seeds, grain, timber, and hides. Important imports are salt, piece goods, sugar, cattle, metals, oil, and yarn.

Of the mineral products, coal has been the most developed; the coal mines produce more than a million tons a year. There has been little exploitation of the copper, iron, diamonds, and gold, which are also found.

Hyderabad has some thousands of miles of improved highways, and there are 799 miles of broad gauge and 638 miles of meter gauge railway, a good part of which is state owned.

**Education and Government.** Osmania University, established in 1918 at Hyderabad, the capital, is the chief educational institution. Instruction is given in both Urdu and English, in seven arts and professions to about 3,000 students. Throughout the state there are some 5,500 primary and secondary schools.

The government of Hyderabad, formerly headed by the nizām, an executive council and a legislative council, the majority of whom were government officials, in 1948 was taken over by an Indian military government with plans for a wide liberalization.

**History.** The ruling family of Hyderabad was founded by the Mohammedan Asaf Jah, a Turkoman soldier of ability, who in 1713 was appointed Subadar of the Deccan by the Emperor Aurangzeb. Within a few years Asaf Jah had thrown off the control of the Delhi government. Following his death in 1748, his descendants quarreled over the succession, with





Natives work on rich farm lands of Hyderabad

the British and French espousing the causes of different aspirants to the throne. The British-supported Ali won; and in 1792 and 1799 he acquired, in wars with Tippoo Sultan, new territory, which he ceded to Britain in 1800. In 1853 the Nizam assigned Berar to the British in payment for the support of the Hyderabad military contingent. During the 1857 Mutiny the Nizam and his troops remained loyal to the British. In 1902 a new arrangement for Berar was made with the British, which gave the British a perpetual lease to the territory in payment for an annual rental of about \$550,000. At this same time the Hyderabad military contingent was made a part of the British Indian forces. Following the partition of India (Aug. 15, 1947) into the two dominions of Pakistan and India, Hyderabad for a time refused to accede to either government; but a customs and defense agreement was consummated with India in 1948. In September, 1948, India took over the state. C.S.

**HYDERABAD**, fourth largest city of India, capital of the former feudatory state, located on the right



Char Minar, an arch with four minarets, was built in 1591 at a main intersection in city of Hyderabad

## Hydra

bank of the Musi River, 390 miles by rail N of Madras. Founded in 1589 by Mohammed Kuli, it is one of the most striking of Oriental cities. It is surrounded by a stone wall flanked by bastions. Its chief features are the palaces built by various nizams, the Nizam College (affiliated with Madras University), and Osmanian University (established in 1918). Hyderabad is an important center for general trade, and its market for Deccan-bred ponies attracts dealers from all parts of Asia. Pop. (1941) 739,159.

**HYDERABAD**, or **Haidarabad**, city, Pakistan, Sind Province, Hyderabad District, situated on a hill three miles from the left bank of the Indus River, some 95 miles by rail NE of Karachi, Pakistan capital. The city, founded in 1768 by Ghulian Shah Kalhora, was the capital of Sind until 1843, when Karachi became the capital. Hyderabad has manufactures of gold and silver embroidery, silk, lacquered ware, pottery, and cotton processing. There are four high schools, a medical school, teachers colleges, and an agricultural and technical school. Pop. (1941) 127,521.

**HYDNUM**, a genus of fungi, terrestrial and parasitic, characterized by the hymenium, or fructifying surface, being spread over awl-shaped prickles or tubercles, which are distinct at the base and project downward like spines, or the teeth of a comb. They have fleshy bodies, which in several species are edible, and in none poisonous. Among the best is the European *H. erinaceum*, the "satyr's beard," occasionally found in clefts of old oaks. In the United States, the *H. caputmedusae*, of a dark, creamy color, with long, drooping, soft spines, is found in similar situations, and has a sweet and aromatic taste. *H. repandum*, resembling in contour an agaric, has a buff-colored or light red cap, very smooth in texture. It is found in woods and open places and when raw has a sweet, slightly pungent taste.

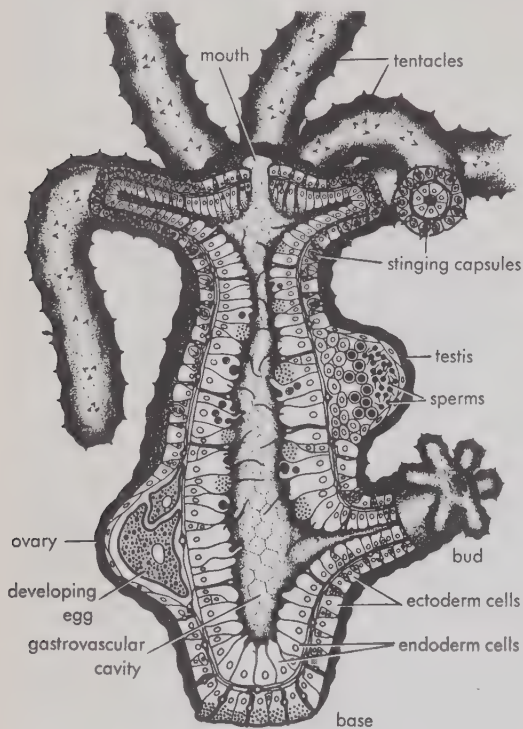
**HYDRA**, in Greek mythology, a nine-headed monster, the spawn of Typhon and Echidna, inhabiting the Lernaean swamp in Argolis. As soon as one head was cut off two sprang up in its place, until HERCULES scared the stumps with fire. The mouths were charged with a deadly poison, in which Hercules dipped his arrows.

**HYDRA**, a fresh-water polyp belonging to the class Hydrozoa of the phylum Coelenterata. Hydras are cosmopolitan in distribution and are generally found attached to weeds in ponds and running water. They measure from one-fourth to one-half inch in length and vary in color from white to green or brown. The slender, contractile body is cylindrical, consisting of a two-layered body wall (ectoderm and endoderm) surrounding an internal central cavity, known as the *gastrovascular cavity*. The terminal mouth is surrounded by tentacles armed with stinging cells, which are used to capture the minute organisms upon which hydras feed. Hydras secrete a sticky substance at the foot which serves to hold the animal to some fixed object. They move either by gliding along the sticky foot or by somersaulting.

The gastrovascular cavity of hydra has a dual function, that of digestion and circulation. When food is ingested it goes to the gastrovascular cavity, where it is digested by enzymes produced by the *gland cells* of the endoderm. The movement of *flagella*, whiplike processes extending from certain endodermal cells into the gastrovascular cavity, circulates the digested food throughout the cavity until it is taken in by the nutritive cells of the endoderm. The food eventually passes to the other cells of the body by diffusion. Since hydra has only one external opening, undigested particles are eliminated through the mouth. Respiration and excretion in hydra are accomplished by diffusion through the body wall.

When well fed, the hydra buds, and after a time the buds break away from the parent, finally developing into adult forms. Sexual reproduction may also occur. Some species are hermaphroditic, producing eggs and sperms; others have separate sexes. The

sperms, which are formed in the testes, are released into the water, swim to a female hydra containing ripe eggs, and fertilize the eggs. After fertilization the eggs undergo development as far as the gastrula stage



Internal structure of a hydra

and are then shed into the water, where they reach the adult form.

Many interesting behavioristic phenomena have been observed in hydra. When the animal is strongly stimulated, the entire body contracts. If a small animal touches a tentacle, the animal is immediately grasped by the other tentacles and directed into the hydra's mouth. Sometimes in its haste to obtain such food, the hydra swallows its own tentacles, which, fortunately, are not digested. Other responses of hydra are the migration toward light and regions of higher oxygen concentration, and the migration away from high temperatures. Like many other animals, hydras have the remarkable ability to regenerate lost or injured parts. Tentacles and other parts of the body are easily replaced, and if the hydra is cut into several pieces, a new individual is formed from each piece. Three American genera of hydras are recognized, *Hydra*, *Chlorohydra*, and *Pelmatohydra*.

L. M. S.

**HYDRA**, the Water Snake or Sea Serpent, an ancient CONSTELLATION that extends over nearly seven hours of RIGHT ASCENSION and from declination about  $7^\circ$  N by  $-35^\circ$  S (see CO-ORDINATES, CELESTIAL). Its head is a small pentagon of stars south of the Praesepe cluster in Cancer, and somewhat west and south of the

bright star Regulus, while its tail is south of Spica. The only bright star in Hydra, second MAGNITUDE and slightly red, is on the meridian at 9 P.M. toward the end of March; it was known to the Arabs as Alhard the "solitary," and to Tycho Brahe as Cor, the heart of Hydra. The constellation includes the globular star cluster M 68 (NGC 4590), an interesting spiral nebula, or GALAXY, M 83 (NGC 5236), and a planetary nebula NGC 3242. (See ASTRONOMICAL CATALOGUES.) In the multiple system  $\epsilon$  Hydrae, the period of revolution of one pair of stars is 15 years, and of another, 9 days (see DOUBLE STAR). The fainter component of the eclipsing binary, SX Hydrae, is a VARIABLE STAR whose brightness range is four magnitudes in a period of 2.9 days. R Hydrae, a long-period red variable star, is remarkable for the rather steady decrease in the period of its brightness variation, from a 500-day period at the time of its discovery in 1704 to a 400-day period at present.

A. T. M.

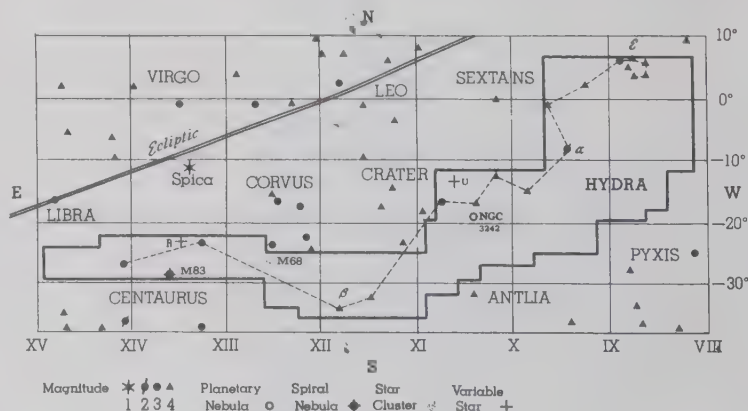
**HYDRAGOGUES** are drastic CATHARTICS producing watery stools, which often contain blood and shreds of the lining membrane of the intestine. Very irritant, they may produce vomiting, inflammation of the intestinal tract, and violent colicky pains with discomfort. They are now seldom used except in combination with milder cathartics. Most hydragogues are resinous acids and glucosides, of which podophyllin, jalap, and scammony are the best known representatives.

THEODORE KOPPANYI

**HYDRANGAEA**, a genus of deciduous shrubs belonging to the family *Saxifragaceae*. They have large corymbose heads of small flowers, white, pink or blue, with enlarged, showy, marginal, sterile flowers. In some cases the whole head is composed of these sterile flowers. The hardiest of the cultivated species to the northward are *H. paniculata*, *H. radiata*, and *H. arborescens*, all of which are tall shrubs or trees. *H. hortensis*, as well as several other species, are often forced for the Easter season.

**HYDRATE**, a crystalline compound formed when a definite amount of water enters into chemical combination with a chemical compound, usually a salt. When a hot saturated solution of cupric sulfate in water is allowed to cool, blue crystals are formed. Analytical data reveals that, in crystallizing, each molecule of cupric sulfate unites with 5 molecules of water to form hydrated cupric sulfate crystals having the composition  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .

The combined water in a hydrate, called water of crystallization or water of hydration, is held loosely and may be expelled by gentle heat. When hydrated



The Constellation Hydra

cupric sulfate crystals are heated gently the water of crystallization may be completely expelled to leave a white, powdery substance called *anhydrous* cupric sulfate ( $\text{CuSO}_4$ ).



The properties of a hydrate are usually different from those of the anhydrous substance. Thus anhydrous cobalt chloride,  $\text{CoCl}_2$ , is blue while the hydrated form,  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ , is red. The hydrated and anhydrous forms of the same substance also differ in density and in solubility.

Some compounds form different hydrates which differ in composition only in the number of molecules of water of crystallization which are combined with a molecule of the compound. The mineral GYPSUM has the composition  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  while a PLASTER OF PARIS molecule contains one-fourth as much water of hydration and has the composition  $(\text{CaSO}_4)_2 \cdot \text{H}_2\text{O}$ . The compound  $\text{CrCl}_3 \cdot 4\text{H}_2\text{O}$  is a green substance having different characteristics from  $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$  which is a gray-violet substance.

Other important hydrates include washing soda  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ ; EPSOM SALTS,  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ ; GLAUBER'S SALT,  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ ; and ALUM,  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ . BAUXITE, from which aluminum is extracted, is a hydrated form of aluminum oxide,  $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ . LIMONITE, the chief ore of iron in France and Germany, is hydrated ferric oxide,  $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ .

E. M. W.

**HYDRAULIC DRIVE**, a method of imparting rotary motion through a liquid coupling. The principal parts of such a drive consist of two dish-shaped, multiple-vaned plates (a driver and a follower) facing each other in a sealed housing containing a heavy oil. The driver (impeller) is directly connected to the driving motor, on whose shaft it rotates. This rotation pumps oil into the follower (runner) whose vanes catch the vortex of oil and force the follower into motion. No metal to metal contact is needed, as the follower runs in a similar way to a turbine wheel and so drives the mechanism attached to its drive shaft.

Operating on the hydrokinetic principle, this type of power transmission is used to connect internal combustion engines and generators. It extends the life of machinery, as the fluid driving medium "cushions"

sudden shocks that might, with a rigid drive shaft, cause a breakdown.

Industry has found a wide range of uses for the hydraulic drive. Presses, drawbenches, winches, cranes and hoists, mining and oil well machinery benefit from its flexibility. Many diesel powered ships are propelled by a marine fluid drive.

When driven through oil, the internal combustion engine acquires the ability to throttle down and start off as smoothly as a steam engine. Hydraulic transmission of power under various trade names, as used in automobiles today became available to the American public in 1939. Hydraulic drives, however, were used in European automobiles as early as 1920.

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**HYDRAULIC ENGINEERING** is that branch of engineering science which deals with the generation, control and practical use of fluid force. See **ENGINEERING, CIVIL**.

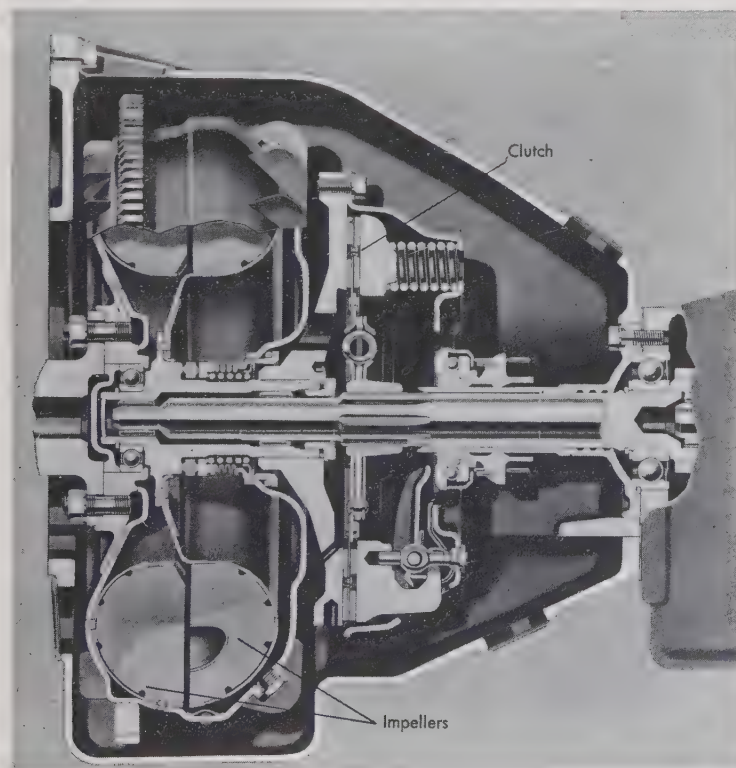
**HYDRAULIC MACHINERY.** Hydraulic machinery may be classified as follows: (1) Machines built to transform, more or less continuously, energy of moving water into mechanical energy. Among these will be mentioned the different kinds of hydraulic turbines, turbines, and hydraulic engines and motors. (2) Machines in which water or other liquids, such as oil, act as a medium for the transmission of power. Included in this category are pipe lines, hydraulic rams, giants, and pistons, which have many applications in presses, jacks, turbine-governors, accumulators, elevators, etc.

#### HYDRAULIC PRIME MOVERS AND HYDROELECTRIC UNITS

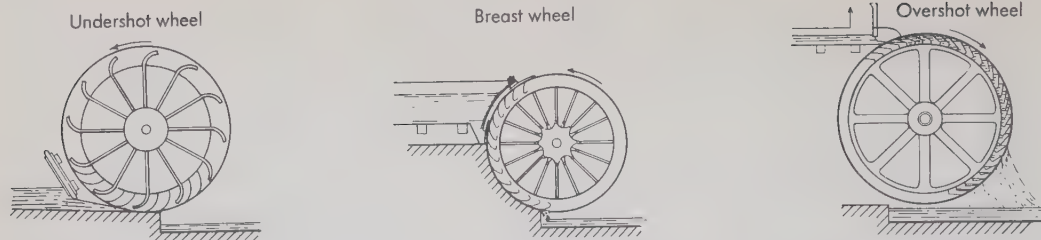
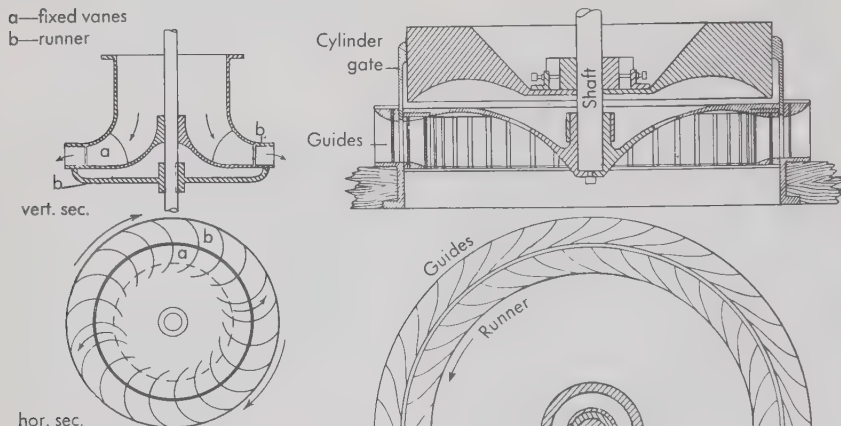
The tremendous extension in the use of electric power, with its flexibility of operation and its ease of transmission, has made obsolete all of the old water wheels as well as many of the early types of hydraulic turbines, and stimulated development of modern hydraulic turbines suitable for driving electric generators.

At present only a few over-shot water wheels are still in use, principally for use in driving grist mills and flour mills. Custom flour and grist mills with individual water power developments are gradually disappearing in most communities as the old machinery wears out, and instead of a series of many small developments on a given stream we find them replaced by a single hydroelectric unit utilizing their combined head and the full flow of the stream. Other and considerably less numerous uses of hydraulic turbines are for direct connection to pulp-grinding machines, for pumping under certain conditions, etc. In general, electric generators of a high speed are more economical than low-speed generators and directly connected hydraulic turbine and generator affords more reliable operation than a belted or geared connection.

The hydraulic turbine development for a period of years progressed principally



**Hydraulic or Fluid Drive** is readily adapted to automotive transmission and insures shock-free motive power with smooth, quick acceleration

**Undershot Wheel****Breast Wheel****Overshot Wheel****Fig. 1. Old types of waterwheel, now obsolete for the generation of electricity****Fourneyron Turbine****Francis Turbine****Fig. 1a. Outward flow and inward flow reaction types of hydraulic turbine**

along the line of increasing the speed of rotation under a given head. Since about 1927, attention has been paid to increased efficiency at part load on high specific speed turbines, such as the propeller type turbine. The principal types of the now practically obsolete water wheels are the undershot, breast and overshot wheels which are shown in Fig. 1. These are true water wheels in the older sense because it was the weight of the water that acted directly upon the wheel: motion of the water relative to the buckets was merely incidental in getting the water into and out of the buckets.

The Fourneyron Outward Flow Reaction Turbine shown in Fig. 1a was one of the first hydraulic turbines, and was first installed at Pont sur l'Ognon, France, in 1827. The American improved version of it by Boyden was installed at Lowell, Massachusetts, in 1844. Also shown in figure 1a is the original Francis type Inward Flow Reaction Turbine first developed experimentally by J. B. Francis in 1847 and later developed gradually into the modern mixed flow turbine known as the Francis turbine.

**Modern Turbines.** The hydraulic prime mover as now almost universally used is an inward and downward flow reaction turbine, known as the Francis type turbine, the propeller type known as the fixed blade propeller, the Kaplan type with movable propeller runner blades, and the impulse wheel.

The reaction and propeller type turbines differ from the older wheels in that water by its pressure and by its velocity head acts simultaneously on all the vanes of the wheel. In the mixed flow reaction turbine and the propeller type turbine, which have been most generally used during many years, the water enters the wheel casing at the outer edge of the gates or guide vanes and flows spirally toward the center of the runner; at the same time, the stream lines turn until they are approximately parallel with the shaft, which may be either horizontal or vertical. In the case of the horizontal shaft, the water after passing

through the runner is carried through an elbow down into a vertical tapered pipe, known as the draft tube, to the tail race. The end of the draft tube is always submerged. In the case of the vertical shaft, the elbow for turning the flow from horizontal to vertical stream lines is, of course, unnecessary, but an elbow draft tube is often used and directs the flow again in the horizontal direction.

The available power in a given situation depends upon the flow of water, usually expressed in cubic feet per second, the fall or head, usually expressed in feet, which can economically be developed and, of course, upon the efficiency of the turbine. If  $hp$  = horsepower,  $Q$  = flow in cubic feet per second,  $H$  = net head in feet, and  $e$  = efficiency of the turbine, the horsepower is given by the equation

$$hp = \frac{QeH}{8.83}$$

For preliminary investigations, it is customary to assume  $e = .85$ , corresponding to 85% efficiency. The modern turbine, however, has a peak efficiency of over 90 per cent.

The type of turbine used depends primarily upon the head available. For heads under 20 feet, open flume construction is usually employed—with occasionally a pier or two to direct the water to the turbine gates. For heads from 20 to 70 feet, it is customary to use a concrete spiral scroll case. For heads from 70 to 300 feet, plate steel spiral scroll cases are usual, and for higher heads within the limit of reaction turbines, cast steel or cast iron spiral scroll cases. For heads above 800 feet, the impulse wheel is usually employed.

The general arrangement of a hydroelectric plant, particularly the setting of the turbines may best be presented by a series of illustrations of existing developments.

One of the cheapest turbine settings is that in which the turbine is placed in a rectangular water-



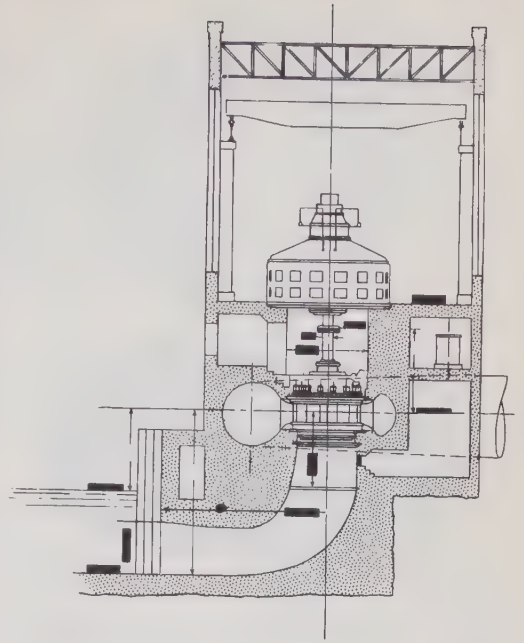
filled room and no concrete or steel scroll case assists in giving direction to the water flow as it enters the turbine. The runner of this turbine is known as the Kaplan propeller type runner. This type is now being used for heads up to 105 feet and it operates at its best efficiency at a higher speed than any other, and thus allows a much smaller diameter of generator. The blades are made to move in synchronism with the turbine gates, and maintained in such relationship with them as to produce high efficiency at all loads. The gate-blade relationship is determined by tests. This principle has been the outstanding recent development in the turbine field. It was discovered by Dr. Victor Kaplan of Czechoslovakia, developed and expanded by him and licensed European and American turbine builders, and successfully placed in practical use.

Since 1927, many Kaplan installations have been made in the United States. One of the largest is the Bonneville development on the Columbia River near Portland, Oregon. The propeller is 23 ft. 4 in. in diameter. Each unit develops 74,000 hp at 60 ft. head, and operates at a speed of 75 rpm.

Where the flow and power demand are both constant, fixed blade propeller turbines may be used.

**Head Heights.** Fig. 2 illustrates a turbine setting under 50 feet head. The power house is made a part of the dam, and the scroll case directing the flow of the water into the turbine guide vanes and gates is molded in reinforced concrete. This type of setting has since been used as a pattern by a large number of companies for heads up to 100 feet.

**Bearing Design.** The weight of the revolving parts, both of the generator and the turbine, plus the hydraulic thrust loadings is carried by a disk-type

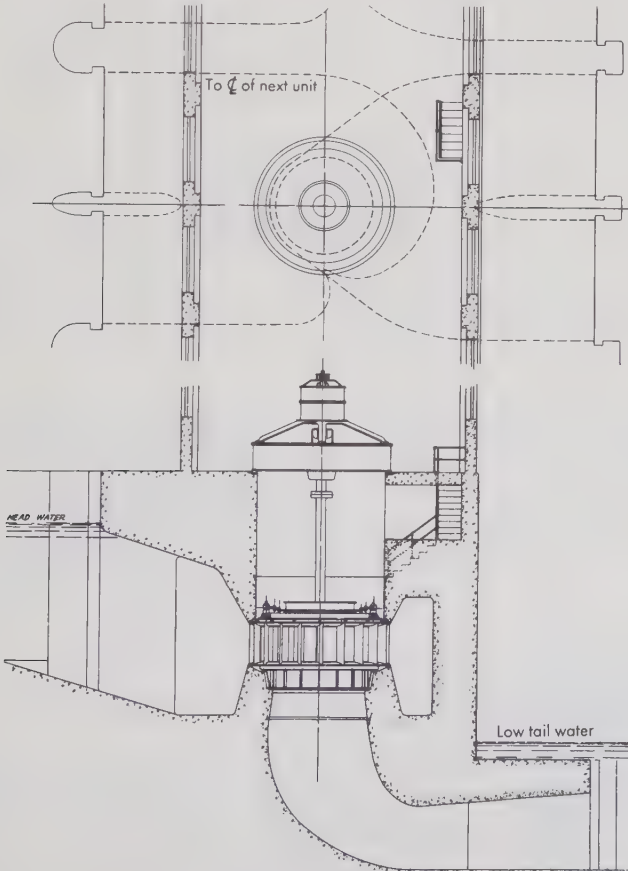


**Typical section through turbine power house**

self-oiling thrust bearing mounted above or below the generator rotor, as shown in Fig. 3. This general

type of thrust bearing has been highly perfected and is one of the most reliable parts of the hydroelectric unit. Loads as high as 3,000,000 pounds are being carried on a single bearing. A steady bearing is located above and close to the runner and is part of the turbine casing. The generator is also provided with self-oiling guide bearings, usually one assembled above the rotor and the other below the rotor. In the case of some low-speed installations the upper guide bearing is omitted and only the thrust and lower guide bearing are provided and assembled below the generator rotor. The principal advantage of this overhung construction is slightly less headroom, and the principal disadvantage is that since alignment depends on the one generator guide bearing and the turbine steady bearing, there is inherently less mechanical stability during transient electric or hydraulic disturbances.

A more recent trend in the generator bearing arrangement for units of relatively large diameter has been to include both guide bearings and locate the thrust bearing below the rotor. With this arrangement the coupling is located farther below the stator and may result in lower station headroom. Further possible advantages



**Fig. 2. Medium low-head turbine setting**



Fig. 3. Generator self-oiling thrust bearing

are the removal of the rotor separately from the shaft without breaking the coupling or disturbing the shaft alignment and lower bearings, thus resulting in greater accessibility, reduced reassembly labor, and reduction in the heaviest crane lift. The bearing surface may be oil- or grease-lubricated babbitt, or water-lubricated lignum vitae, rubber or plastic material. Vertical shaft settings have the advantage of economy in floor space and facility for keeping the electrical equipment safely above high tail water, and usually develop a slightly higher efficiency than horizontal shaft turbines. About 90 per cent of the turbine installations within recent years have been of the vertical shaft type.

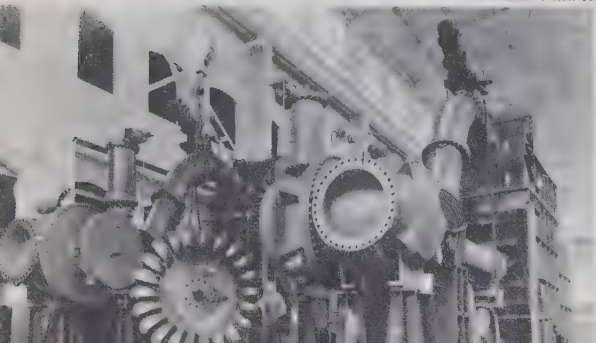
Horizontal shaft units have, however, been widely installed in the past and occasionally a situation is so evidently favorable to this type of setting that it would still be installed today.

**Impulse Turbine.** The turbines described to this point have been of the reaction or mixed flow type wheels. A radically different type of turbine in common use under very high heads is the impulse type. It is simply a rotating disk having buckets at its periphery against which water from one or more nozzles impinges.

In Fig. 4, the runner and nozzle are enclosed in the plate steel casing and after use against the runner, the water drops down into the tail race. Generally a handwheel controls the flow through the nozzle by adjusting the position of the needle valve in the nozzle, but in order to provide accurate regulation, and at the same time avoid heavy water hammer on the pipe line, a lever operated by the governor deflects the jet away from the runner when the electric

Fig. 4. Double overhung, double jet turbine

S. MORGAN SMITH CO.



load lightens and the speed increases. Sometimes the needle is also governor controlled as it is undesirable from a standpoint of erosion to operate with the deflector in the jet. This is especially important in a plant unattended by an operator.

Impulse turbines are made from very small laboratory sizes up to 78,000 hp, but in hydroelectric developments, they are rarely used for heads under 400 feet except when the water contains a great amount of sand. The highest head plant in the world uses this type of wheel. It is the La Dixence plant in the Swiss Alps, which has a net head of 5,700 feet. These units develop 44,000 hp under 5,700 feet with a speed of rotation of 500 rpm. The specific speed is 1.5. The runner is about 11 feet 6 inches in diameter with horizontal double overhung runners, each runner operated by a single jet. Since 1935, the use of vertical impulse turbines with two or four jets is in demand. By means of this type of setting, the unit specific speed is increased to 14 or 15, so that for small installations, impulse turbines may be used economically down to 300 or 400 feet head. An advantage is found in lower maintenance cost than would be obtained with high-head Francis turbines which require special water joints.

For a low-head development, say, 60 feet, it is desirable to use a high specific speed, as this results in the minimum turbine and generator diameter for a given desired power output and, consequently, minimum cost both for apparatus and for the power house structure. As the head increases, it is necessary to reduce the specific speed of the turbine. This is required for mechanical reasons and to minimize cavitation which causes pitting.

**Draft Tube.** The function of a draft tube is to allow the turbine to be placed above ordinary tail water level and to convert into usable power the energy of the water tied up in its high velocity as it leaves the runner. This is done by gradually reducing the water velocity from about 20 feet per second at the top of the draft tube to, say, 4 feet per second at the discharge end of the draft tube.

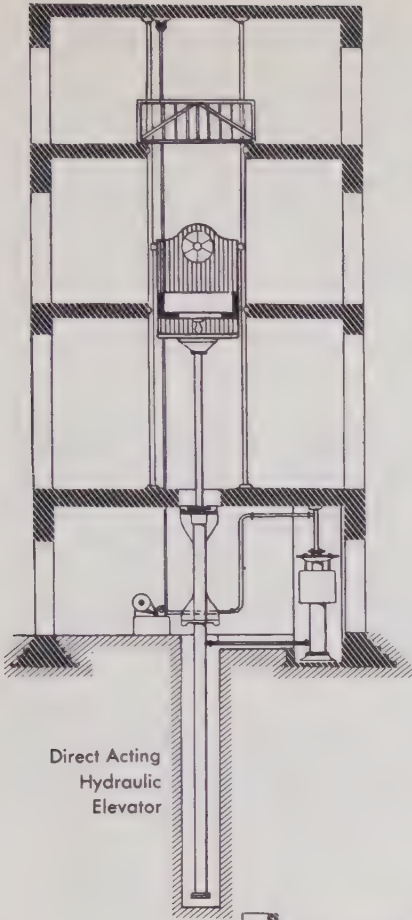
**Speed Control.** Flyball governors for maintaining constant speed of rotation are an essential accessory to turbines. If, on account of decreased load, the turbine speeds up, the governor will operate to close the wicket gates of the turbine, or, in case of an impulse turbine, the speed of the unit can be regulated by means of a needle or the jet deflector. The pressure rise and drop in the penstock is regulated by means of a needle or relief nozzle. See TURBINE, STEAM; GAS TURBINE.

#### THE APPLICATION OF HYDRAULIC POWER

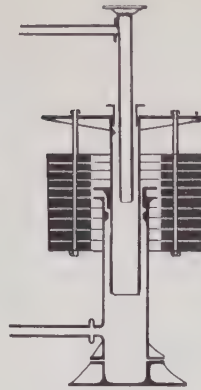
**Hydraulic Cranes.** The hydraulic crane is somewhat like an ordinary pulley tackle reversed, the hydraulic power being applied by a ram acting at the load end of the tackle, the weight raised occupying the place usually assigned to the hand or power. Thus the ram moves much more slowly than the load raised. For instance, take a crane with three cylinders, the rams of which actuate one crosshead, from which the lifting chain passes over multiplying sheaves to the crane jib. Either one, two, or all the rams could be put under pressure, and hence the amount of water (or hydraulic power) required could be varied with the load raised. Without some such arrangement any hydraulic machine raises its smallest load, or does its least amount of work, at the same cost as its greatest.

**Direct-acting Passenger Elevator.** This, the simplest and safest appliance of the kind known, consists of a cage or room constructed of metal, resting on and attached to a long ram which works in a corresponding hydraulic cylinder sunk deeply into the earth in the cellar of the building. The ram, with its room and passengers, moves up under the influence of the water pressure on the ram, which, resting on unyielding water, cannot fall, and even

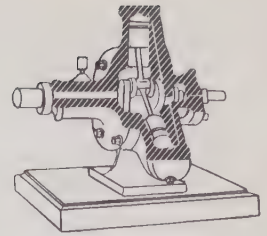




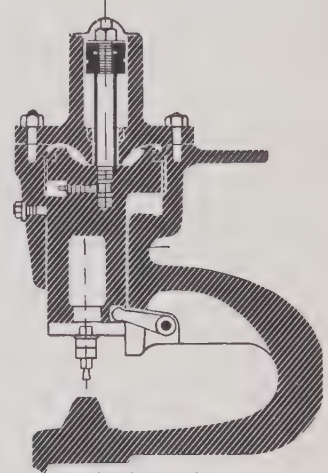
Direct Acting  
Hydraulic  
Elevator



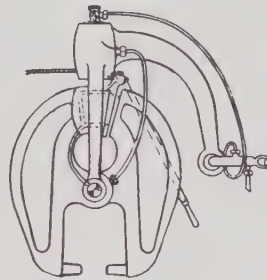
Elevator detail



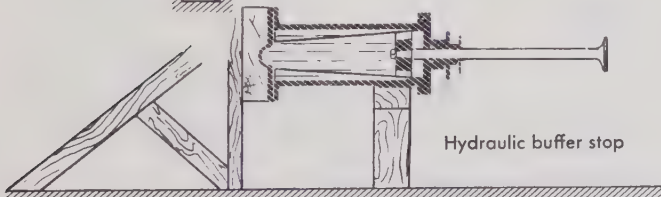
Hydraulic engine



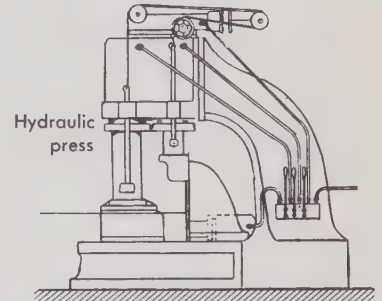
Hydraulic punch



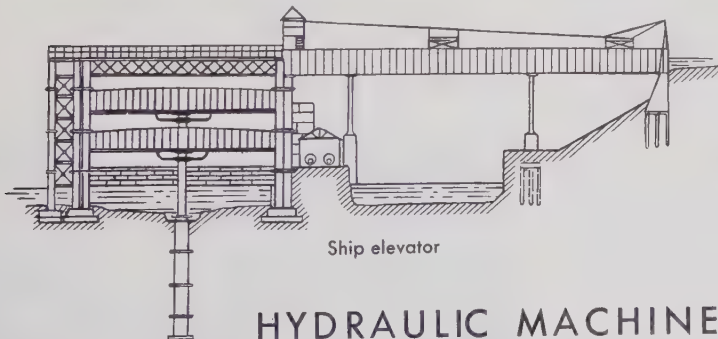
Hydraulic riveter



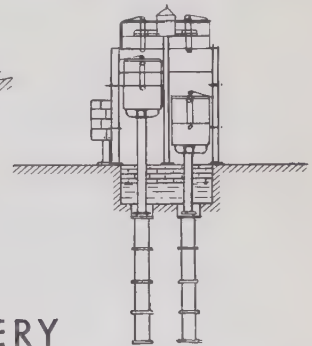
Hydraulic buffer stop



Hydraulic  
press



Ship elevator



## HYDRAULIC MACHINERY

if a valve be opened or a leak occur, it can only fall comparatively slowly. It is, however, an expensive and uneconomical arrangement. The cost of sinking a well for the cylinder from 60 to 100 feet deep, the cost of the cylinder and ram, the weakness of the latter as a strut, and last, but not least, the daily cost of filling this cylinder with pressure water each trip, render this type of elevator unsuitable except for small heights, and in places where pressure water is

cheap. For instance, the weight of the ram may be, say, 1,500 pounds, that of the car 1,220 pounds, while the load raised may be 1,120 pounds. It is evidently more economical to balance the 2,720 pounds of dead weight in some way, and only draw on the pressure supply for the raising of the 1,120 pounds of net load. For this purpose counterweights may be employed; but their use considerably diminishes the safety of the lift, as serious accidents have

occurred through the breaking of the counterweight chains or ropes, or by the giving way of the attachment of cage and ram, the former being then pulled up with great rapidity by the counterweights.

**Hydraulic Balances** are much more usual. In these a weighted cylinder moves vertically on two fixed hollow rams. On the downward journey of the car this weighted cylinder moves up, giving space for a certain portion of the water displaced by the elevator ram in the descent. The energy stored in this weighted cylinder is then available for raising, or partially raising, the dead weight of the elevator, leaving only a comparatively small external supply to be furnished from the mains each journey. The hollow rams are not alike in diameter. This conveys a diminished pressure to the elevator ram, and hence the latter may be of sufficient diameter for strength.

**Suspended Elevators.** In these the cage is suspended usually by four wire ropes, each of which is strong enough to bear the whole load with safety. The ropes are pulled up by a short ram which works in its cylinder, and has multiplying sheaves like a hydraulic crane. No deep well is required for the cylinder, and the speed of the elevator may be much higher than in the case of the direct-acting apparatus. Every elevator of this kind must be supplied with a safety device, the function of which is to arrest the cage should the ropes break or be paid out too rapidly. See ELEVATOR.

**Other Applications.** Hydraulic power has also been used for canal lift locks, to drive shafts and machines, and to operate presses (as cotton balers), riveters, punching machines, forging presses, etc. Much warship machinery was at one time operated hydraulically; and considerable aircraft equipment, as landing gear, flaps, etc., is operated by hydraulic systems. For hydraulic brakes, see BRAKE. G. P. PATTESON; GRANT H. VOADEN

**BIBLIOG.**—F. A. Bradley, *Pumping and Water Power* (1912); E. Molloy, *Hydraulic Machinery* (1941); S. R. Beitler and E. J. Lindahl, *Hydraulic Machinery* (1942); A. H. Gibson, *Hydraulics and Its Application* (1948).

**HYDRAULIC RAM.** In this machine, invented by J. M. Montgolfier in 1796, a large quantity of water under low head is used to raise a smaller quantity of water from the same or another source to a higher point. The working water enters through a large pipe but as soon as the running water has attained considerable velocity, a check valve closes suddenly and the momentum of the column of water is destroyed, resulting in a high hydraulic pressure, like a blow. This forces a small amount of water to a somewhat higher level, and the relieved pressure closes the trap valve, starts the main column of water flowing again, and the process is repeated. Air pressure in the upper portion of the delivery trap prevents the blow of the arrested column of water from becoming too severe. Not highly efficient and of moderate output, hydraulic rams are used in rural areas affording some fall of water.

**HYDRAULICS.** See HYDRAULIC MACHINERY; HYDROKINETICS; HYDROSTATICS.

**HYDRAZINE** is a colorless alkaline liquid. It has the formula  $H_2N-NH_2$ . Hydrazine bears the same relation to AMMONIA as HYDROGEN PEROXIDE ( $HO-OH$ ) to water. Resembling ammonia chemically, it is even more like hydrogen peroxide. Its hydrate and salts are reducing agents, and its organic derivatives are similar to the AMINES. Like hydrogen peroxide, hydrazine has uses as fuel, being the principal fuel in the V-2 rocket and type XXVI submarine.

**HYDRIDE.** See HYDROGEN.

**HYDRIODIC ACID**, a water solution of hydrogen iodide. The latter is a heavy colorless gas with an irritating odor, easily soluble in water. It has the formula  $HI$ . Hydrogen iodide fumes in moist air like hydrogen fluoride, hydrogen chloride, and hydrogen bromide. It resembles these compounds in general, but is less stable than any of them, decomposing

noticeably at  $180^\circ C$ . when dry and more rapidly in solution, especially when exposed to light. It is used as a REDUCING AGENT because of its ease of decomposition.

Salts of hydriodic acid are called iodides. Silver iodide,  $AgI$ , is important in PHOTOGRAPHY. Potassium iodide and sodium iodide are used in medicine. See IODINE, Medical Uses.

Pure hydrogen iodide may be prepared by the action of water on phosphorus tri-iodide, made from the elements; or by the action of iodine on hydrocarbons, such as tetralin ( $C_{10}H_{12}$ ), which can give up part of their hydrogen atoms readily.

**HYDROBROMIC ACID**, a water solution of hydrogen bromide. The latter is a heavy colorless gas having a pungent smell and is very soluble in water. It has the formula  $HBr$ . Hydrobromic acid resembles HYDROCHLORIC ACID in its general behavior. It may be prepared by the action of phosphoric acid on sodium bromide or by bubbling sulfur dioxide gas through bromine water. Salts of hydrobromic acid are called *bromides*. The most important of these are silver bromide, used in PHOTOGRAPHY, and sodium, potassium, and ammonium bromides used in medicine as sedatives or hypnotics.

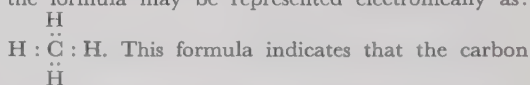
**HYDROCARBON**, a chemical compound composed of only hydrogen and carbon. Hydrocarbons occur in PETROLEUM and in natural gas, and may be derived from soft coal by the process of destructive DISTILLATION. The hydrocarbons are grouped into several different classifications or series according to the composition of the molecules and their chemical reactions.

**Paraffins.** The *paraffins* are a series of saturated hydrocarbons which are not very active at ordinary temperatures. The simplest member of this series is methane,  $CH_4$ . Methane is a colorless, insoluble, flammable gas. It is the chief component of natural gas and makes up about 40 per cent of coal gas.



The structural formula for methane is:  $H-C-H$ . Each

of the single bonds in the formula represents a VALENCE of 1. Therefore the valence of the carbon atom is 4. Since a carbon atom has 4 electrons in its outer shell and a hydrogen atom has 1 external electron, the formula may be represented electronically as:



This formula indicates that the carbon atom shares two electrons with each hydrogen atom.

The second member of the paraffin series is ethane,

**Bottled Gas** used for cooking purposes is composed chiefly of propane and butane of the paraffin series

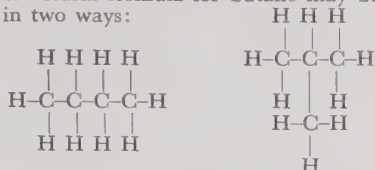
SKELLY OIL CO.





$C_2H_6$ . The third member, propane, has the molecular formula,  $C_3H_8$ . Each member of the paraffin series differs from the one that precedes it by a  $CH_2$  group. Such common difference between successive members of a series is known as a "homolog" and the series is known as a **HOMOLOGOUS SERIES**. The general formula for the members of the paraffin hydrocarbons is  $C_nH_{2n+2}$ . Thus, the fourth member, butane, has the molecular formula  $C_4H_{10}$ , and pentane, the next member, has the formula  $C_5H_{12}$ .

The structural formula for butane may be represented in two ways:



These formulas indicate that the 4 carbon and 10 hydrogen atoms may be arranged in two different groupings. Two different compounds having the molecular formula,  $C_4H_{10}$ , are known. The straight chain compound is called "normal butane" (n-butane) and the branched chain compound is called "isobutane." Compounds which have the same molecular formula but different structural formulas are called "isomers." As the size of the hydrocarbon molecule increases, the number of possible isomers increases rapidly. The number of possible pentanes ( $C_5H_{12}$ ) is 3; hexanes ( $C_6H_{14}$ ) — 5; heptanes ( $C_7H_{16}$ ) — 9; octanes ( $C_8H_{18}$ ) — 18; and nonanes ( $C_9H_{20}$ ) — 35. See **ISOMERISM**.

The first four members of the paraffins or methane series of hydrocarbons are gases at ordinary temperature and pressure. The next 11 members are liquids, and those containing 16 or more carbon atoms in a molecule are solids.

#### BOILING POINTS OF NORMAL PARAFFINS

|             |                |           |
|-------------|----------------|-----------|
| Methane     | $CH_4$         | -161.5°C. |
| Ethane      | $C_2H_6$       | - 88.3°   |
| Propane     | $C_3H_8$       | - 42.2°   |
| Butane      | $C_4H_{10}$    | - 0.6°    |
| Pentane     | $C_5H_{12}$    | 36.2°     |
| Hexane      | $C_6H_{14}$    | 69.0°     |
| Decane      | $C_{10}H_{22}$ | 174.0°    |
| Tetradecane | $C_{14}H_{30}$ | 252.5°    |
| Octadecane  | $C_{18}H_{38}$ | 317.0°    |

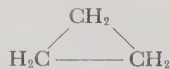
The boiling points of these compounds increase at a fairly uniform rate as the complexity of the hydrocarbon molecule increases. The melting points and the specific gravities also increase in almost regular order with increase in molecular weight.

The lower members of the paraffin series react with chlorine or bromine in sunlight or in the presence of catalysts to form substitution products in which one or more of the hydrogen atoms are replaced by halogen atoms. Thus, methane by reaction with chlorine yields methyl chloride,  $CH_3Cl$ , which by further reactions yields methylene chloride,  $CH_2Cl_2$ ; chloroform,  $CHCl_3$ ; or carbon tetrachloride,  $CCl_4$ . The monochlor substitution product of ethane is ethyl chloride,  $C_2H_5Cl$ :  $C_2H_6 + Cl_2 \longrightarrow C_2H_5Cl + HCl$ . The reaction of the higher paraffins with chlorine yields a mixture of isomeric monochlorides. Propane reacts with chlorine to form n-propyl chloride,  $CH_3CH_2CH_2Cl$ , and isopropyl chloride,  $CH_3CHClCH_3$ .

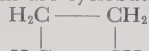
The paraffins react with nitric acid at high temperatures to produce a mixture of nitro compounds. The nitration of propane results in the formation of nitromethane,  $CH_3NO_2$ ; nitroethane,  $CH_3CH_2NO_2$ ; and isonitropropane,  $CH_3CHNO_2CH_3$ .

**Cycloparaffins.** A group of hydrocarbons having the general formula  $C_nH_{2n}$  is also found in petroleum. Like the members of the methane series these hydrocarbons form substitution products with the halogens indicating that their carbon atoms are joined by single bonds (saturated compounds). To account for

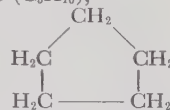
their chemical behavior, a ringlike or cyclic structure is assumed, and the compounds are classed as cycloparaffins. Cyclopropane,  $C_3H_6$ , which is used as an anesthetic, has the structural formula:



Other cycloparaffins are cyclobutane ( $C_4H_8$ ),



and cyclopentane ( $C_5H_{10}$ ),



Cycloparaffins containing up to 26 carbon atoms in a molecule are found in petroleum. These compounds generally have higher boiling points than the corresponding paraffins. They are more active chemically than the open-chain paraffins.

**Olefins.** Among the hydrocarbons obtained from petroleum distillates are a group of compounds which, like the cycloparaffins, have the general formula  $C_nH_{2n}$ . These compounds, however, react with the halogens to form addition rather than substitution products. Such compounds which are capable of adding other atoms are called *unsaturated*. Their structures are represented by double or triple bonds between some of the carbon atoms.

The first member of this series, called the "olefin series," has the molecular formula  $C_2H_4$ . Its structural formula is:

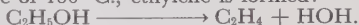


and it is called "ethylene" or "ethene." The next member of the olefins is propylene, or propene,  $C_3H_6$ . Its structural formula is:



There are three isomeric butylenes,  $C_4H_8$ . They are:  $CH_3CH_2CH=CH_2$ ,  $CH_3CH=CHCH_3$ , and  $(CH_3)_2C=CH_2$ .

The olefins may be prepared by the dehydration (removal of water) of alcohols. When ethyl alcohol,  $C_2H_5OH$ , is dehydrated with sulfuric acid at a temperature of 180°C., ethylene is formed:



**ETHYLENE** is a colorless flammable gas. When burned it gives a luminous flame whereas the flames produced by burning methane and ethane are almost colorless. Ethylene is used as an anesthetic and for ripening fruits artificially. By the reaction of ethylene with sulfur monochloride, a volatile, irritating, toxic liquid called "mustard gas" is formed.

The olefins react readily with the halogens to form addition products:



(ethylene chloride). The olefins also form addition products with hydrogen, hydrogen halides, sulfuric acid, hypochlorous acid, and other reagents.

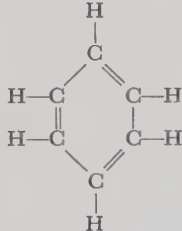
Another series of unsaturated hydrocarbons, known as the acetylene series, has the general formula  $C_nH_{2n-2}$ . The simplest of these compounds is **ACETYLENE**,  $C_2H_2$ . The structural formula for acetylene is:  $H-C \equiv C-H$ . The triple bond between the two carbon atoms indicates a high degree of unsaturation. Acetylene is produced by the action of water on calcium carbide:  $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$ . It is a colorless gas which is odorless when pure but usually has a disagreeable odor due to the presence of impurities. It is used in the oxy-acetylene torch for welding metals. Acetylene is also used in the synthesis of acetone, alcohol, vinegar, rubber, plastics, and many other products.

Some of the other members of the acetylene series are: methylacetylene,  $CH_3C \equiv CH$ , ethylacetylene,  $CH_3CH_2C \equiv CH$ , and dimethylacetylene,  $CH_3C \equiv C-CH_3$ .

Hydrocarbons containing two double bonds be-

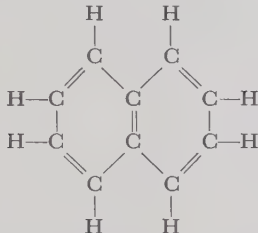
tween carbon atoms in a molecule are called "di-olefins" or "dienes." Butadiene and isoprene, which are used in the production of synthetic rubber, belong to this group of compounds. See BUTANE, BUTYLENE AND BUTADIENE; RUBBER.

A series of unsaturated cyclic hydrocarbons, many of which are obtained from soft coal by destructive distillation, are called "aromatic hydrocarbons" because many of these compounds have pleasant odors. The simplest member of this series is BENZENE,  $C_6H_6$ . Its structural formula is:



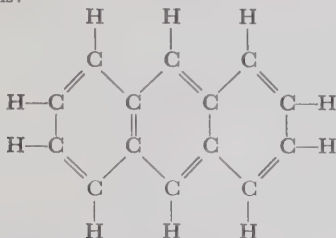
TOLUENE,  $C_7H_8$ ; xylene,  $C_8H_{10}$ ; and mesitylene,  $C_9H_{12}$ , together with benzene, form a homologous series having the general formula  $C_nH_{2n-6}$ . The aromatic hydrocarbons and their derivatives are widely used in the production of coal-tar dyes, explosives, and drugs.

Some aromatic hydrocarbons contain more than one benzene ring in a molecule. NAPHTHALENE,  $C_{10}H_8$ , has the structural formula:



It is obtained from coal tar by fractional distillation. It is used in large quantities in the preparation of synthetic dyes, smokeless powders, celluloid, in moth balls, and in the production of many derivatives.

ANTHRACENE,  $C_{14}H_{10}$ , is another aromatic hydrocarbon which is obtained from coal tar. Its structural formula is:



It forms a number of important substitution products which are useful in the preparation of dyes. E. M. W.

BIBLIOG.—L. F. Fieser and M. Fieser, *Organic Chemistry* (1944); A. Lowy, B. Harrow, and P. Apfelbaum, *Introduction to Organic Chemistry* (1945).

**HYDROCEPHALUS** is a condition in which there is an excessive accumulation of fluid within the ventricles (cavities) in the brain. (See CEREBROSPINAL FLUID.) It may be congenital (present at birth) or acquired. Obstruction to the outflow of fluid from the ventricles is a common cause of what is called *chronic internal hydrocephalus*. The enlarged head of an infant with hydrocephalus may obstruct labor. It is more often noticed for the first time after birth. Headache is common and convulsions may occur. The mental condition is variable, but as a rule there is some interference with mentality. Most children born with hydrocephalus die within the first few years of life; however, the process may be arrested

and the child can grow to maturity. Occasionally a chronic hydrocephalus may be acquired in later life with or without observable cause. The symptoms are variable but headache is common. Various operations have been devised to aid drainage of the accumulated fluid, but these frequently do not give satisfactory results. The typical enlarged high-domed head is characteristic and makes diagnosis easy.

EDWIN P. JORDAN, M.D.

**HYDROCHLORIC ACID**, or **MURIATIC ACID**, one of the most active of the mineral acids, is obtained by dissolving hydrogen chloride in water. Hydrogen chloride is a pungent, colorless gas of suffocating odor, heavier than air and highly soluble in water. Its solubility in 100 grams of water at  $0^\circ\text{C}$ . and one atmos. is 82.3 grams; its boiling point is  $-83^\circ\text{C}$ . and its melting point  $-112^\circ\text{C}$ . The formula for hydrogen chloride, or its water solution (hydrochloric acid) is  $\text{HCl}$ .

Hydrochloric acid was discovered by a 15th-century alchemist Basilus Valentinus who made it by heating a mixture of common salt and ferrous sulfate.

In the most commonly used modern method of manufacture, a batch of sodium chloride and sulfuric acid is heated in a cast-iron muffle furnace equipped with rakes for stirring the fuming mixture. The reaction proceeds in two stages, in the first of which one mol of acid is formed at a relatively low temperature;  $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}\uparrow$ . Complete conversion is effected only by raising the temperature to a much higher point;  $\text{NaCl} + \text{NaHSO}_4 \rightarrow \text{HCl}\uparrow + \text{Na}_2\text{SO}_4$ . The hot gas contaminated with droplets of sulfuric acid and dust is cooled in Pyrex glass or silica condensers and then filtered as it passes through boxes or towers packed with Coke. Its absorption in water to form a concentrated solution is brought about in heavy acid-proof chemical stoneware or silica vessels.

In the synthetic process electrolytic chlorine and hydrogen, with hydrogen in slight excess, are combined to produce a highly pure acid. It may be made also, as in the Dow magnesium process by burning electrolytic chlorine with natural gas (methane) with a regulated amount of air;  $2\text{Cl}_2 + \text{CH}_4 + \text{O}_2 \rightarrow 4\text{HCl} + \text{CO}_2$ . Its high solubility in water makes its separation from the carbon dioxide and residual nitrogen relatively easy.

Although far less useful than sulfuric acid in its applications to chemical industry, hydrochloric acid nevertheless plays an important part even though its original use as an intermediate for making chlorine by oxidation processes has been entirely superseded by electrolysis of SODIUM CHLORIDE. It dissolves more or less readily most of the metals except the so-called noble family, gold, silver, and platinum, and so is invaluable for making a long series of salts which in turn become intermediates for further synthesis. In glue making it dissolves the calcium phosphate and carbonate from bones to leave the organic substance free; it is used in steel pickling to clean the surface of sheet preparatory to galvanizing or plating; in petroleum production it is an effective agent for dissolving the limestone obstructions in the well that impede the flow of the oil. Perhaps only its highly corrosive action on steel shipping containers that limits transport to the use of glass or to rubber lined tanks prevents a much wider industrial consumption. United States production in 1943 was 330,000 tons, less than 5 per cent of the equivalent sulfuric acid output for the same period.

*Salts of Hydrochloric Acid.* Far more useful than the acid itself are the chloride salts produced by the action of the acid on the metals. With the exception of silver and mercurous chlorides they are all soluble in water and so the metallic ion may be made available for the synthesis of a great variety of other salts both soluble and insoluble. The more important metallic chlorides include barium chloride, calcium chloride, ferric and ferrous chlorides, magnesium chloride, mercuric chloride, silicon tetrachloride, sodium chloride, and zinc chloride.

H. L. OLIN



## Hydrocyanic Acid

**HYDROCYANIC ACID, HYDROGEN CYANIDE, or PRUSSIC ACID**, was discovered by Scheele in 1782, and is a product of the decomposition of the **AMYGDALIN** present in bitter almonds, wild cherry, laurel, peach kernels, etc. Hydrocyanic acid has the formula  $\text{HCN}$ . Hydrocyanic acid is a highly volatile colorless liquid (m.p.  $-14^{\circ}\text{C.}$ , b.p.  $26^{\circ}\text{C.}$ ), with an odor like bitter almonds that is imperceptible to many people. The liquid has the highest dielectric constant of any known substance.

Hydrocyanic acid is chiefly used as a fumigant and in certain chemical synthesis. Although it enters the market as aqueous solutions of 2 to 10 per cent strength, it is ordinarily prepared at the time and place of use by adding sulfuric acid to a cyanide. Usually sodium or calcium cyanide is used. See **FUMIGATION**.

Chemically, hydrocyanic acid is a feeble acid, faintly reddening litmus. It forms salts, the **CYANIDES**, that are in some respects like the halides (see **HALOGEN**), but are poisonous, and form complex acid radicals such as the ferrocyanides and ferricyanides. Aqueous solutions of hydrocyanic acid do not keep well, except in presence of a trace of mineral acid.

**Poisoning.** Hydrocyanic acid is one of the most intense poisons known and probably the most rapidly acting. The cyanides are all toxic because of their conversion to hydrocyanic acid in the stomach. The symptoms of hydrocyanic poisoning include open, fixed staring eyes with large pupils, frothing from the mouth, fixed jaws, and bright red or purple patches on various parts of the body, particularly under the fingernails. Immediate treatment is imperative.

**HYDRODYNAMICS.** See **HYDROKINETICS**; **HYDROSTATICS**.

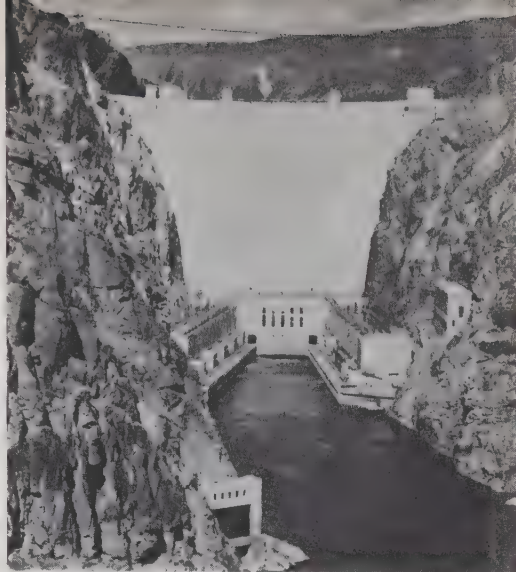
**HYDROELECTRIC POWER** is electric power produced through the use of water power. A modern hydroelectric power plant in the United States can supply electricity within a circular area of 200,000 square miles, an area twice as large as the combined area of New York, Pennsylvania, and New Jersey. Normally, slightly over one-third of the electric power produced in the United States is hydroelectric power; water power is a particularly important source of electricity in Switzerland, Sweden, and the Soviet Union, and is being expanded in India and China.

Hydroelectric power depends upon either waterfalls or man-made dams for its creation. Typical of the former type of installation are those at Niagara Falls. Typical of the latter are the installations along the dams in the Tennessee Valley, where the **TENNESSEE VALLEY AUTHORITY** has created new sources of electricity for use in both industry and agriculture. See **DAM**.

The main advantage of hydroelectric power is that it does not destroy natural resources in producing power, as electric power produced from coal does. Its disadvantages are the special geographical requirements for the building of plants, and the high cost of building dams and other major installations. For this reason, hydroelectric power will never completely supplant other power sources.

**How the Power is Produced.** Special tubes called penstocks conduct the water, either from behind a dam or from the upper section of a stream before it reaches a waterfall. At Niagara Falls, for example, the tubes drop the water 150 feet from the surface of the Niagara River above the falls. The water is conducted to strike the wheels of turbines, which provide the power to turn electric generators. The type of turbine used and the construction of the casing depend upon the head of water which strikes the turbine wheel. See **HYDRAULIC MACHINERY**.

From the generators, the electric current is transported to the consumers. Hydroelectric power plants usually send power further from the powerhouse than power plants that produce electricity from coal. See **POWER TRANSMISSION, ELECTRICAL**.



BUREAU OF RECLAMATION  
**Hoover Dam**, one of the largest dams in the world, controls the floods of the Colorado River

**History.** The first attempt in the United States to create electricity by electric power was made by the inventor, Lester Pelton, who developed the Pelton water wheel whose divided buckets made a theoretical 100 per cent efficiency possible. He built a wheel at the Chollar mine of the Comstock Lode in 1880, and hitched it to a dynamo which provided the power for a stamp mill. The Fourneyron turbines at Niagara Falls were in operation in 1895. The success of the Niagara development led to the use of dams for the production of artificial heights of water which could be used to run electric generators. The largest of these man-made dams is **HOOVER DAM** in the Colorado River, which has been described as the heart of the most difficult engineering feat ever attempted in America.

**Social Importance.** During the first half of the 20th century, the percentage of power supplied from water in the United States remained roughly stable, at about four per cent of the national consumption of energy. This does not mean that U.S. sources of hydroelectricity have remained stable; the national consumption of energy increased vastly during this period, and the competing sources of energy in coal declined, while the use of oil and natural gas enormously increased.

One major advantage of hydroelectric energy lies in the fact that the dams which provide the head of water whose energy moves the turbines are also useful for other purposes. This makes construction of dams more economically feasible when they can also be used for flood control and irrigation purposes as in the case of Hoover Dam, or to provide a source of water supply, as in the case of Hetch Hetchy Dam in California. The same installations which provide power are often an important force for conservation.

**Future.** Hydroelectric power has had its enthusiastic advocates, such as the late Charles Steinmetz, and those who have believed it has already reached its peak, such as Herbert Hoover. On the one hand, it faces coal-produced electrical power which has steadily become more efficient. On the other, it faces the prospect of competition from atomic power, which may hamper its further development, although it is not expected to compete with existing installations. By its very nature, however, the further development of hydroelectric power is expected to become more and more a governmental function. Only the government has the legal access to waterways, the huge sums to sink as capital investment into installations, and the ability to co-ordinate the production of hydroelectricity with other functions such as conservation and water supply. See **WATER POWER**. **GEORGE MANN**

**HYDROEXTRACTOR.** See CENTRIFUGE.

**HYDROFLUORIC ACID**, a solution of hydrogen fluoride gas in water. It has the formula HF or  $\text{H}_2\text{F}_2$ . The acid is prepared by heating calcium fluoride with concentrated sulfuric acid. Although highly reactive chemically, it is considered a weak acid. See FLUORINE; GLASS ETCHING.

**HYDROGEN**, a gaseous element, produced in the 16th century by Paracelsus, a Swiss, when he placed iron in sulfuric acid. In 1766, HENRY CAVENDISH collected some of the gas and recognized it as a distinct substance. Because of its inflammability he called it "inflammable air." LAVOISIER later named the gas "hydrogen" because it forms water when burned.

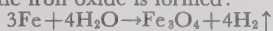
Hydrogen is a colorless, odorless, tasteless gas. It is the lightest substance known. A liter of hydrogen at standard conditions weighs 0.08987 g; a liter of air weighs 1.293 g. Hydrogen thus has greater lifting power than any other gas, and is used in lighter-than-air craft. Military dirigibles and blimps in the United States, however, are filled with helium, which has about 92 per cent the lifting power of hydrogen, but is incombustible.

Hydrogen is the best heat conductor of all gases. It condenses to a colorless liquid at  $-252.78^\circ\text{C}$ . (atmospheric pressure). The lightest known liquid, it has a specific gravity of only 0.07.

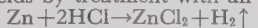
The chemical symbol of hydrogen is H. Its atomic weight is 1.008 and its atomic number 1. Hydrogen with atomic weight 2 was discovered by UREY in 1932 and named DEUTERIUM. These "heavy hydrogen" atoms are present in HEAVY WATER. In 1934 a third hydrogen isotope with atomic weight 3 was discovered and named TRITIUM.

Uncombined hydrogen is not abundant in nature. Gases which issue from volcanoes, and natural gas usually contain some free hydrogen. It is believed that free hydrogen occurs abundantly in the atmospheres of the sun and many stars, and also in interstellar space (see INTERSTELLAR MATTER; MILKY WAY). Hydrogen occurs chiefly in combination with oxygen as water. It also occurs in many fuels, in acids and alkalis, in living tissues, and in many organic substances such as sugars, glycerin, alcohols, oils, fats, waxes, etc.

**Preparation.** Hydrogen may be obtained from water by ELECTROLYSIS or by treating the water with an active metal, such as sodium or potassium. When steam is passed over heated iron hydrogen is released and magnetic iron oxide is formed:



Hydrogen may be obtained from dilute hydrochloric or sulfuric acids by treatment with an active metal:



Hydrogen is prepared on a large scale by (1) the electrolysis of water ( $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ ); (2) by passing steam over hot coke ( $\text{C} + \text{H}_2\text{O} \rightarrow \text{CO} + \text{H}_2$ ); (3) by passing steam through natural gas in the presence of a catalyst ( $\text{H}_2\text{O} + \text{CH}_4 \text{ (methane)} \rightarrow \text{CO} + 3\text{H}_2$ ). The hydrogen is separated from a mixture with carbon monoxide by cooling the mixture until the carbon monoxide solidifies.

**Uses.** The high temperature produced by the combustion of hydrogen with oxygen is utilized in the oxy-hydrogen blowpipe, which produces a temperature of about  $2400^\circ\text{C}$ . The clean, hot flame is used for cutting and welding iron and steel and other metals.

An atomic hydrogen torch, developed by the General Electric Company, produces a temperature between  $4000^\circ\text{C}$ . and  $5000^\circ\text{C}$ . Hydrogen gas is passed through an electric arc the heat of which breaks up hydrogen molecules into atoms ( $\text{H}_2 \rightarrow 2\text{H}$ ). When the hydrogen atoms reunite, the energy absorbed when the molecules were split into atoms is released, thus adding to the heat released by the burning of hydrogen molecules.

The estimated world's annual consumption of pure hydrogen is about 300,000 tons. Large quantities of the gas are used in the synthetic production of ammonia by combining hydrogen with nitrogen. (See AMMONIA.) Large quantities of hydrogen are also used in processes in which hydrogen, through catalytic action, is made to combine with other substances to form useful products. Such a process, known as HYDROGENATION, is used extensively for converting cheap liquid oils into semisolid fats.

Hydrogen combines readily with oxygen. When it is passed over many heated metallic oxides it acts as a REDUCING AGENT by removing the oxygen and leaving the pure metal. Cheaper reducing agents, such as carbon (coke) are used for this purpose in industry.

Hydrogen combines with some metals to form hydrides. Sodium hydride, NaH, and calcium hydride,  $\text{CaH}_2$ , are examples of such compounds. Hydrides of the metals are unstable and have little commercial value.

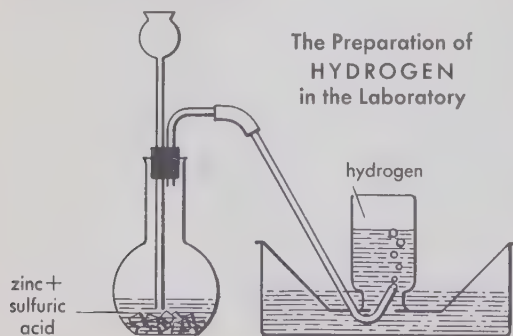
**HYDROGEN BOMB**, the most destructive weapon known to man, became a reality on March 1, 1954, when the U.S. Atomic Energy Commission set off its first successful H-blast in the Marshall Islands in the Pacific Ocean. The test bomb had the power of 12,000,000 tons of TNT and was considered to be seven hundred and fifty times as powerful as the atom bomb which was exploded over Hiroshima, Japan, in 1945 during World War II.

At the end of January, 1950, President Truman announced that the United States had embarked upon the construction of a hydrogen bomb, and funds were later appropriated for this purpose. At that time, scientific opinion varied between absolute certainty that such a weapon could be made, and a feeling that there was only a fifty-fifty chance.

The atomic bomb produced during World War II relied upon the splitting apart, or fission, of the atoms of either uranium 235 or plutonium for its deadly effect. The hydrogen or H-bomb relies upon the fusion of various types of hydrogen atoms to liberate forces many times as great. The fission of the atomic bomb depends upon atoms of either uranium 235, plutonium 239, or possibly uranium 233 capturing an atomic particle called a neutron. The fusion of the hydrogen atoms is accomplished by forces of tremendously high energy, which are needed to overcome the electrical repulsion that exists between the nuclei of the atoms. These high energy forces exist naturally in the interior of the sun and other stars. Many scientists believe that the energy of the sun is produced by fusion of hydrogen and other atoms in the interior of the sun where the temperatures are almost  $20,000,000^\circ\text{C}$ .

There are several ways in which the three isotopes of hydrogen can produce the energy of the bomb. These three isotopes are hydrogen 1 (protium), deuterium 2 (found in "heavy water"), and tritium 3, which is also radioactive. The nucleus of hydrogen 1 consists of a proton, that of deuterium of a proton and a neutron, that of tritium of a proton and two neutrons. The nuclei of deuterium and tritium are called respectively a deuteron and a triton.

When a proton and a triton fuse, an atom of helium 4 (whose nucleus consists of two protons and two neu-





trons) is produced. In the process, 19,900,000 electron volts of energy are given off. When two deuterons fuse, the result can be one atom of hydrogen 3 (one proton and two neutrons), plus one atom of hydrogen 1, plus 4,000,000 electron volts of energy. Or else the fusion can result in one atom of helium 3 (this time with two protons and a neutron in its nucleus), release one neutron, and also give off 4,000,000 electron volts. When two tritium nuclei fuse, they result in one atom of helium 4 (two protons, two neutrons in its nucleus), plus two neutrons given off, as well as 11,400,000 electron volts. The fusion of deuterium and tritium would result in one atom of helium 4 (two protons, two neutrons), plus one neutron, and give off 17,600,000 electron volts of energy. In addition, fusion of a deuteron with a light element such as lithium could result in an even greater burst of energy.

The main problems of the hydrogen bomb seem to be two in number. One is to provide the necessary amount of the heavier isotopes of hydrogen, which promises to be expensive, particularly so in the case of tritium. The second problem is to provide the energy needed for the start of the fusion reaction. It has been logically suggested that this energy could come from an explosion of an ordinary atomic bomb, which momentarily creates temperatures as high as 90,000,000° C. Perhaps the most favored of the preceding processes, in terms of practicality, is the one in which a proton and a triton fuse. This would, physicists say, liberate eight times as much energy as a uranium or a plutonium bomb. But technically, all seem to be feasible. Hydrogen fusion liberates energy equal to eight tenths of 1 per cent—or eight grams in a kilogram—of matter. Uranium or plutonium fission converts only one tenth of 1 per cent of matter into energy.

The effect of the H-bomb has been variously estimated, and also obviously depends upon the size of the bomb itself. Most public speculation about the H-bomb has revolved around estimates that it would be a thousand times as powerful as the A-bomb dropped on Hiroshima. If that is the case, figuring the Hiroshima bomb as officially stated to be equivalent to 20,000 tons of TNT, the H-bomb would be the equivalent of 20,000,000 tons of TNT.

The Hiroshima bomb could have blasted an area of a mile diameter completely, if it had been exploded at 2,000 feet, where it would have created the worst havoc. If the H-bomb were only eight times as powerful as the A-bomb, it would destroy a circular area two miles in diameter. If it were a thousand times as powerful, the central zone of destruction—complete absolute destruction—would be 10 miles across. And heavy damage would exist inside a zone 20 miles across and cover 300-some square miles.

One great danger of the bomb has been that it could be rigged, not only to kill by blast, but to produce radioactive dusts that would be equally deadly. One scientist has estimated that 500 pounds of deuterium, in a single H-bomb, could create a dust that would kill every living thing in the world. Smaller bombs presumably could be rigged to contaminate smaller areas. Other scientists have speculated that the H-bomb might set off a chain reaction in the hydrogen which naturally exists in the earth and the air, and thus destroy the world itself.

Ever since 1915 it has been scientifically known that the hydrogen fusion could produce energy. An article by W. D. Harkins of the University of Chicago established that on a theoretical basis. Later, the English physicist, F. W. Aston, elaborated on the idea. In 1929, R. Atkinson of England and F. Houtermans of Germany set forward the theory that the energy of the sun and the stars could be explained in terms of a thermonuclear reaction involving a series of atomic changes that would provide energy while not diminishing the mass of the sun appreciably in the long run. The cycle involved hydrogen, helium, carbon, and other atoms. At George Washington University, Pro-

fessors George Gamow and Edward Teller solidified this theory which has won general acceptance.

The H-bomb test proved that the destructive capacity of any hydrogen bomb is almost limitless, depending only on size. Any desired amount of the chief explosive element, lithium-six deuteride, may be used. Twenty-two tons of the element would be equivalent in explosive force to 1,000,000,000 tons of TNT.

**HYDROGEN ION**, the name given to a hydrogen atom from which an ELECTRON has been removed. It has the symbol  $H^+$ , but in solution it may exist as  $H_3O^+$  (HYDRONIUM ION), and is a common part of Acids. Hydrogen ions consist of a positively charged particle called a *proton*. As such they are used as projectiles for bombarding atomic nuclei. Negative hydrogen ions,  $H^-$ , called *hydride ions*, also exist.

**HYDROGEN PEROXIDE**, or **HYDROGEN DIOXIDE**,  $H_2O_2$ , a sirupy liquid of faint blue color, that mixes with water in all proportions. It is unstable and decomposes readily into water and oxygen, with the liberation of heat. The decomposition is rapid and explosive if the pure liquid is heated, but slower in dilute solution, and greatly retarded by the presence of a trace of mineral acid or of acetanilide.

Hydrogen peroxide is a powerful oxidizing agent (see OXIDATION AND REDUCTION), displacing iodine from potassium iodide solution, converting sulfides to sulfates, etc. Because of its oxidizing action hydrogen peroxide is an excellent bleaching agent and is used for bleaching ivory, feathers, hair, wool, bone, fats, and fur. In some cases it appears to act as a REDUCING AGENT. In its action on silver oxide, for example, it apparently reduces this compound to free silver. In acid solutions hydrogen peroxide usually acts as a reducing agent, while in alkaline solutions it acts as an oxidizing agent.

Any medicinal action that hydrogen peroxide may have is due mostly to its rapid decomposition into oxygen and water. The liberated oxygen oxidizes and thus destroys all kinds of organic debris that may generate stench and harbor infective micro-organisms. All living matter contains at least some enzymes (peroxidase ferments, catalases) that break down peroxide, giving rise to oxygen bubbles.

Hydrogen peroxide in strong solutions is very irritant and may injure the skin. It is used in two kinds of dilute solution. One of these, a 3 per cent solution in water, has a very evanescent action, because the oxygen is liberated with great rapidity, and when all the oxygen has disappeared the deodorant and antiseptic action ceases. Nevertheless, this agent has been employed not only for its brief germicidal effects on the skin and the oral cavity, but also for cleaning out pus pockets. A 1.5 per cent solution of hydrogen peroxide in glycerin has marked and somewhat more prolonged bactericidal effects on a great variety of micro-organisms on the skin and in the mouth.

Hydrogen peroxide is obtained by the action of dilute sulfuric acid on hydrated barium peroxide, barium sulfate being precipitated, and the aqueous solution concentrated by evaporation on a water bath, followed by fractional distillation under reduced pressure. Very pure and highly concentrated hydrogen peroxide is produced by the electrolysis of ammonium sulfate and sulfuric acid at low temperature.

During World War II the Germans produced about 3,000 tons a month of 80–85 per cent hydrogen peroxide for use with a fuel and a catalyst in launching V-1 flying bombs, for driving fuel pumps in the V-2 bombs, and for driving torpedoes. Hydrogen peroxide was also used for providing a supply of oxygen for use in submarine engines and in two types of aircraft.

Hydrogen peroxide may be detected by its action with dilute potassium dichromate solution containing a little sulfuric acid to form a blue coloration which on exposure to air quickly fades. The addition of an ether layer after the formation of the blue coloring prevents the fading because, when the mixture is

shaken, the blue substance dissolves in the ether and becomes more stable.

**HYDROGEN SULFIDE** or **SULFURETTED HYDROGEN**,  $\text{H}_2\text{S}$ , a colorless, poisonous gas which is used extensively in chemical analysis. The gas has the odor of rotten eggs. It is formed naturally by the decay of animal and vegetable matter containing sulfur compounds, and is a constituent of "sulfur waters." Hydrogen sulfide is prepared in the laboratory by the action of an acid on ferrous sulfide:  $\text{FeS} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S}$ . The gas is denser than air and dissolves in about one-third its volume of water to form a weakly acidic solution called hydrosulfuric acid.

Hydrogen sulfide burns with a blue flame in an excess of air, forming water vapor and sulfur dioxide:  $2\text{H}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 2\text{SO}_2$ . In a limited supply of air the products of combustion are water vapor and sulfur:  $2\text{H}_2\text{S} + \text{O}_2 \rightarrow 2\text{H}_2\text{O} + 2\text{S}$ . Hydrogen sulfide reacts with salt solutions of many metals to form insoluble colored metallic sulfides which precipitate. The sulfides of lead, copper, silver, and mercury are black, zinc sulfide is white, antimony sulfide is orange, cadmium sulfide is yellow, bismuth sulfide is brown. The coloration produced when hydrogen sulfide is passed into a solution of a compound being analyzed often enables the chemist to identify the metallic ions present in the solution. Some of the colored metallic sulfides are useful as pigments. Cadmium sulfide,  $\text{CdS}$ , is employed as a yellow pigment for toilet soaps, antimony sulfide,  $\text{Sb}_2\text{S}_3$ , is used as the pigment in red rubber, and zinc sulfide,  $\text{ZnS}$ , is a component of the paint pigment lithopone.

Hydrogen sulfide is highly toxic, a concentration of 1 per cent in air being fatal. The victim of hydrogen sulfide poisoning should be given fresh air, and artificial respiration should be applied. The administration of a mixture of oxygen with 5 per cent carbon dioxide is helpful.

**HYDROGENATION**, the process of combining **HYDROGEN** with other substances to form more useful products. Such actions are usually brought about through the use of catalysts. Liquid oils are converted into solid fats by hydrogenation. The oil is heated to about  $200^\circ \text{C}$ . and, in the presence of finely divided nickel, hydrogen is forced in under pressure. Cooking fats such as Crisco, Spay, and Snowdrift, are thus obtained from inedible vegetable oils. The yield of gasoline from petroleum is increased by hydrogenation processes. Low-grade coal is being hydrogenated in some European countries to produce gasoline.

Benzene and naphthalene are converted into useful fuels and solvents by hydrogenation. Methyl alcohol is synthesized by hydrogenating carbon monoxide. The hydrogenation of fats produces alcohols which are being used in the production of "hard water soap." See **DETERGENT**; **OIL**; **FAT**; **PETROLEUM**; **BERGIUS**, **FRIEDRICH**.

**HYDROGRAPHY** is the physical geography of the waters of the earth. It embraces the description of the rivers, their regimen, their sculptural agency, and the causes which modify their courses; the description of the lakes, with the causes of their formation and extinction, and the movements and thermal changes of their waters; and the description of all the marine areas of the globe. Hydrography treats of the contours of the ocean bed from the sea level down to the greatest depths; the temperature, circulation, physical and chemical properties of sea water; the currents, tides, and waves; the composition and distribution of marine deposits; the aspects of biological oceanography; and the relations of man to the ocean in the development of navigation, commerce, and civilization. Hydrography thus has relations with astronomy, geography, geology, physics, chemistry, and the biological sciences.

The use of the sea from early times as a highway of communication and transportation made it of advantage for nations to supply their vessels with

information respecting the navigation of those coasts and waters to which their voyages might be directed. Thus there grew up, in connection with the governmental systems of the maritime nations, institutions called hydrographic offices, whose purpose has been to conduct nautical surveys and prepare charts primarily for employment in navigation, and also to collect and conserve those observations of the navigator concerning the physical geography of the sea, which, when collated and digested, are of practical importance in the exercise of his calling. The name hydrography has been applied to the art of making nautical coast surveys. This art comprises the determination and delineation, upon a plane surface, of the areas and depths of bodies of water, of the nature and form of the bottom, and of the figure and position of the adjacent shores and outlying rocks or shoals; also the representation of natural or artificial marks which serve as aids to navigation, and the observation and reduction of the tides and currents. Such surveys are usually connected with trigonometrical and topographical surveys, which serve to lay down the shore lines and locate the objects above water, and to provide a basis for the subsequent operations of representing the depths of water over the shoals and in the channel on nautical maps and charts. See **CHART**; **GEOGRAPHY**; **GEOLOGY**; **OCEAN**.

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**HYDROKINETICS** is that branch of the subject of hydrodynamics which deals specially with the motion of fluids under the action of force. The flow of liquids is due to three principal causes: gravity, pressure differences, and inertia. Various types of fluid motion may be distinguished. The simplest of all is that of uniform steady motion. By uniform motion is meant motion which is the same in direction and magnitude at all points, so that the mass of fluid which is moving in this manner moves as if it were solid, and may be treated mathematically as such. No account is taken of the fact that a fluid may be regarded as a system of molecules, and we limit the discussion to an ideal fluid from which friction is entirely absent. Nevertheless, except in the cases of the more viscous fluids, the results correspond closely with actual facts; and the general nature of the deviations friction brings in can always be allowed for.

If, in addition to being uniform throughout the mass, the motion is also steady, no change takes place in the motion of any part of the fluid at any time. For in steady motion, if we fix our attention on a particular point in space, the motion of the fluid at that point never alters from second to second, though it may be greatly different from point to point. Since in this case the motion is also supposed to be uniform, the velocity at all points is the same, and remains so from second to second.

The motion may, of course, be steady without being uniform. A specially important case of this kind occurs when the motion is constant in direction, and is uniform throughout any one of a set of parallel planes, while it varies in magnitude from one to another of these planes in strict proportion to their distance apart. Such motion is called *shearing motion*, and is closely exemplified in the slow motion of water in a wide canal, the parallel planes being all horizontal. In all such cases, in addition to considering the mere motion of any small portion of the fluid as a whole, we have to take account of the motion of its own different parts relatively to each other. This is completely determined when the change of form of the element is given as it passes from position to position. In this respect the problem becomes one of strain, with the additional idea of time involved.

Since all strains can be classified as rotational or nonrotational, we are thus led to distinguish two broad classes of fluid motion—*rotational* or *vortical* motion, and *nonrotational* motion. *Each of these may be*



*steady* or *unsteady*; the latter alone can be uniform. When the motion is nonrotational, the mathematical investigation shows that the component of speed in any given direction can be expressed as the rate of variation, per unit of length measured in that direction, of a quantity which depends on the position chosen. When the motion is not steady the time is also involved in this quantity, which is called the velocity potential (compare the gravitational potential). It is found that, when a velocity potential exists—i.e., when the motion is nonvortical—the motion might have been produced from rest, or, on the other hand, the moving fluid might be brought to rest instantaneously by the application of a suitable system of impulsive forces.

**Motions of Fluids.** The actual path of any one element of fluid is termed a *stream line*, or a line of motion. An envelope of lines of instantaneous motion is termed a *line of flow*. These coincide, and are perpendicular to the surfaces of equal velocity potential, when the motion is nonrotational. As an illustration of the difference, consider the motion of points on a spoke of a wheel rolling along level ground. Each point traces out a curve known as an epicycloid. This is the stream line—the actual path of the particle. The lines of flow, on the other hand, are circles whose center is that point of the rim which is at the instant in contact with the ground.

To investigate any case of motion of a fluid we have to form the fundamental equations of hydrodynamics, which are fully explained in texts on the subject. These equations involve, in general, five unknown quantities (pressure, density, and the three components of speed) and two specific conditions. One of these is usually a relation connecting the pressure and density, while the other condition is generally given the appellation "equation of continuity."

**Conservation of Energy.** Some cases of motion can be solved very simply by consideration of the principles of conservation of energy and matter. Bernoulli's equation, expressing such considerations for incompressible fluids, is the basis of the common (but incomplete) statement that in a fluid "the speed is greatest where the pressure is least." To modify it for compressible fluids, we must account for work done in compression or spent in expansion. It contains the explanation of the transverse motion of eddies gliding down a stream, the action of spin on the flight of a ball, and the motion of a fluid past a solid. It is therefore associated with the **BERNOULLI PRINCIPLE**, which tells us that the greater the velocity of a fluid past a surface, the lower the pressure against that surface. To apply this reasoning to calculate the speed of water escaping from a small orifice in a vessel, the condition to bear in mind is that the gain of kinetic energy per unit mass is equal to the loss of potential energy. We can then find that the speed of escape is the same as would have been acquired by free fall of the water from rest at the level of the upper surface.

**Vortical Motion.** In the case of vortical motion, it can be easily proved that the product of the area of section into the angular velocity of the fluid at that section is constant. Hence, as we do not contemplate the existence of infinite angular velocities in nature, we see that a vortex must be endless or have its ends on a free surface of the fluid. This was first proved by von Helmholtz. Eddies or whirlpools are the ends of such vortices. The fact, already alluded to, that vortical motion cannot be produced or destroyed by impulsive forces, was made by Lord KELVIN the bases of his theory of vortex atoms, since it accounted for conservation of matter. When a fluid has a boundary, a further condition, called the "boundary condition," has to be introduced. This simply expresses the fact that the component of the speed of the fluid normal to the boundary is zero. See **REYNOLDS NUMBER**; **HYDROSTATICS**.

**BIBLIOG.**—R. C. Binder, *Fluid Mechanics* (1943); H. Lamb, *Hydrodynamics* (1945); H. Rouse, *Elementary Mechanics of Fluids* (1946).

**HYDROLOGIC CYCLE**, the recurrent path followed by a representative particle of water from the time it is evaporated from the ocean until it returns to the ocean. The path may be short and simple, or long and complex. Conceivably it may never be completed, but such an occurrence would be exceedingly rare. There is probably considerable truth in the oft-quoted remark, of anonymous authorship, that "a drop of water, evaporated from the ocean, rains five times, and returns to the ocean."

There are many possible paths by which the circuit can be completed. Water may be evaporated from the ocean, condense, and fall as rain on the same ocean from which it came. It may be transported landward, as water vapor, fall as rain, and, while falling through a layer of relatively dry air, be re-evaporated before it reaches the earth. It may fall on vegetation and be evaporated from the surfaces of the plants on which it fell. It may fall on the earth and run off immediately, returning via the streams and rivers to the ocean, or it may penetrate the top layer of the earth and circulate through the earth as ground water, issuing finally from some spring, and contributing to a stream or river on its way to the ocean. As ground water it may be absorbed by the roots of some plant and stored up for a while in plant tissue, or it may be evaporated from the pores of the leaves (*transpired*). The possible paths are numerous and varied, but, in nearly all cases, the paths followed lead eventually to the sea.

It is difficult to make any exact quantitative statements concerning the amounts of water that travel any one path. Of all the water evaporated from the earth's surface, probably 80 per cent falls as rain directly on that surface. The remainder is either intercepted by vegetation or re-evaporated while falling. Of the water that falls on the earth's surface, the relative amounts which run off, evaporate, or seep into the ground vary so much in different areas that no very exact figures can be given for the earth as a whole. In the United States from 10 to 50 per cent of the rainfall runs off at once, from 10 to 30 per cent evaporates, and from 40 to 60 per cent is absorbed by the soil. Of the entire rainfall, from 15 to 30 per cent is used in some way by plants, either to form plant tissues or to be transpired. In the end nearly all of it returns to the oceans, from which it came, thus completing the hydrologic cycle. See **PRECIPITATION**; **FLOOD**.

**HYDROLYSIS**, the term applied to those chemical actions in which decomposition is brought about by the action of water. Such reactions are of many varieties, e.g., the reaction of salts formed from a weak acid or base with the ions of water; the conversion of **ESTERS** into **ACID** and **ALCOHOL**; the inversion of sugars; the formation of acid and ammonia from nitriles, etc. The mere addition of water is sufficient to cause hydrolysis in some cases. Some hydrolysis reactions are brought about by the addition of water together with the application of heat, often under pressure and frequently with the addition of small quantities of acid or alkali.

Hydrolysis plays an important part in the **DIGESTION** of foods in the body. The hydrolysis of proteins in the stomach is effected through **ENZYME** action and results in the formation of proteoses, peptones, peptides, and finally **AMINO ACIDS**. With the help of enzymes, complex **CARBOHYDRATES** and **FATS** are also hydrolyzed into simpler substances which can be assimilated by the body.

Many salt solutions have an acidic or basic reaction because they hydrolyze. For example, cupric sulfate when dissolved in water gives an acidic solution. The cupric sulfate is ionized into cupric ions ( $\text{Cu}^{++}$ ) and sulfate ions ( $\text{SO}_4^{--}$ ). (See **ION**.) The water is ionized to a slight degree to yield hydrogen ions ( $\text{H}^+$ ) and

hydroxyl ions ( $\text{OH}^-$ ). Most of the cupric ions and hydroxyl ions form molecules of cupric hydroxide and leave very few hydroxyl ions in the solution. The sulfate ions and the hydrogen ions remain in the solution in their original concentration. The presence of an excess of hydrogen ions accounts for the acidic character of the solution. See ACIDITY AND NEUTRALIZATION.

E. M. W.

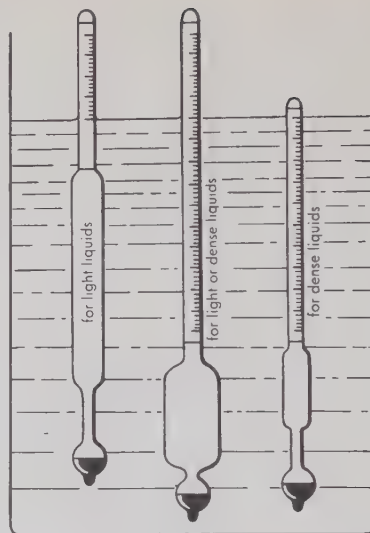
**HYDROMECHANICS**, the science dealing with the application of liquids as motive power for machinery, whether depending on the statical principles exemplified in the hydraulic press, or on the laws of liquids in motion such as govern the action of the hydraulic turbine. Hydromechanics includes the mechanics of fluids including hydrostatics, hydrodynamics, hydrokinetics and pneumatics. See HYDRAULIC MACHINERY; HYDRAULIC DRIVE.

**HYDROMEL**, a beverage, either fermented or unfermented, composed of honey and water. When fermented it is called MEAD, or vinous hydromel, to make which one part of honey is dissolved in three parts of boiling water—spices, ground malt, and yeast being added.

**HYDROMETEOR**, a condensate of atmospheric water-vapor whether formed in the atmosphere or at the earth's surface. The U.S. Weather Bureau classifies hydrometeors (1938) as:

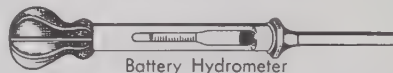
- I. Liquid water droplets or ice crystals suspended in the air, i.e., not falling from aloft out of clouds:
  1. Damp haze
  2. Fog—light, moderate, heavy
  3. Ice fog (pogonip)
  4. Drifting snow
  5. Blowing snow
- II. Precipitation: products of condensation which
  - (a) Fall more or less continuously or in showers:
    1. Rain
    2. Snow
    3. Rain and snow, mixed
    4. Sleet
  - (b) Fall almost exclusively in showers:
    5. Snow pellets
    6. Small hail
    7. Hail
  - (c) Never fall in showers:
    8. Drizzle
    9. Snow grains
    10. Ice crystals
- III. Water (liquid or solid) deposits on ground objects, formed by condensation, freezing, or sublimation:
  1. Frost
  2. Rime—hard and soft
  3. Glaze

**HYDROMETER**, or **AREOMETER**, an apparatus for measuring, or more strictly comparing, the densities of liquid. There are various forms, but all are direct applications of the hydrostatic principle of ARCHIMEDES, which states that when a solid is wholly or partially immersed in a liquid, its apparent weight is diminished by the weight of the liquid which has been displaced. When the substance floats in the liquid, the weight of the amount of liquid displaced will be exactly equal to the weight of the body; hence more or less of the floating body will be immersed according as the liquid is lighter or heavier. In the great majority of cases the liquids under investigation do not differ much, as regards their density, from water. For this reason the floating body or hydrometer must be made of such a form as to show very slight differences of density. The instrument consists of a glass bulb drawn out into a narrow tube above, and loaded below with sufficient quicksilver or other ballast to keep it erect in the liquid with the bulb wholly immersed. The narrower the neck or tube as compared with the bulb, the more sensitive will be the hydrometer. A slight increase in the density of the supporting liquid, will cause the hydrometer to



Different types of hydrometers

float a little higher, and the length of neck projecting above the surface of the liquid will indicate the density of the liquid. In instruments of this type the neck is graduated, so as to show at a glance the exact density of the liquid in which the hydrometer is floating. Hydrometers may be calibrated to show the specific gravity of the liquid directly or in degrees Baumé. (See BAUMÉ.)



Battery Hydrometer

A sensitive hydrometer is incapable of measuring densities through a great range; hence it is necessary to construct different forms for measuring correspondingly different groups of liquids. Hydrometers used for determining the density of milk are known as lactometers. The saccharometer is used for determining the sugar content of a sugar solution. The urinometer is employed to detect the presence of sugar and other substances in urine. The hydrometer is commonly used in determining the freezing point of alcohol-water antifreeze mixtures, and the degree of charge of storage batteries. See DENSITY; SPECIFIC GRAVITY.

S. W. X.

**HYDRONIUM ION**, a combination of a hydrogen ion (proton),  $\text{H}^+$ , with a molecule of water. It has the formula  $\text{H}_3\text{O}^+$ . The hydronium ion is present in a solution of a strong acid, such as hydrochloric acid:



See BRÖNSTED THEORY; ION.

**HYDROPHOBIA**. See RABIES.

**HYDROPONICS**, the method of growing plants in a water medium, accomplished by adding necessary chemical nutrients and furnishing means of support. See SOILLESS GARDENING.

**HYDROQUINONE**, paradihydroxy benzene  $\text{C}_6\text{H}_4(\text{OH})_2$ , is prepared by the oxidation of aniline to quinone by potassium bichromate and sulfuric acid, followed by reduction of the product by sulfurous acid and extraction with ether. Hydroquinone is a colorless, odorless crystalline solid (mp  $169^\circ \text{C}.$ ), that has a slightly sweet taste. It is somewhat soluble in water, gives a green color with ferric chloride, and acts as a reducing agent, being used for that purpose in photographic developers.

**HYDROSTATIC**. The subject of hydrostatics comprises a study of the behavior of liquids at rest. Customarily matter is divided into three categories, namely, solids, liquids and gases. The line of demarca-



tion between them, however, is not always sharp. Sealing wax, for example, is generally regarded as a solid, yet if a stick of it is gripped at one end and extended horizontally, it will be found, after a few days of normal temperature, to have sagged, indicating that the resistance to shear was not sufficient to offset the external shearing force of gravity acting on it. The result is a permanent deformation. Liquids and gases are generally classified as fluids.

The development of the study of liquids may be based upon seven fundamental propositions as outlined below. With some modification they may be applied to gases.

**Proposition I.** The pressure at any point below the free surface of a liquid is the same in all directions. Pressure is defined as the force per unit area. The unit may be one of several. In the British system it is the pound per square inch which is customarily used. In the metric system a convenient unit is the dyne per square centimeter.

**Proposition II.** The pressure on any surface below the free surface of a liquid is at right angles to the surface. Assume for the moment that the pressure were not at right angles to the surface. It could then be broken up into two components, one at right angles to the surface and the other parallel to the surface. The one parallel to the surface would tend to set the liquid in motion, which is contrary to fact.

**Proposition III.** The pressure on any horizontal plane beneath the free surface of a liquid is the same at all points on the plane. A disregard of this proposition often leads to erroneous conclusions in the analysis of hydrostatic phenomena.

**Proposition IV.** The pressure at any point below the free surface of a liquid is directly proportional to the depth at that point.

**Proposition V.** The pressure below the free surface of a liquid is directly proportional to the density of the liquid. By density is meant the mass of the liquid per unit volume. The customary unit in the British system is the pound per cubic foot, while in the metric system it is the gram per cubic centimeter.

**Proposition VI.** The pressure at any point below the free surface of a liquid is directly proportional to the acceleration of gravity.

**Proposition VII.** The pressure on a confined liquid is transmitted equally, and is undiminished in all directions. This is known as Pascal's Law. The action of the hydrostatic press depends on the validity of this law.

**The Application** of the propositions assumes that the liquids are incompressible and will withstand no shearing forces. Propositions IV, V, and VI may be summed up in the following simple expression:

$$p = h d g$$

where  $p$  is the pressure or force per unit area,  $h$  the depth,  $d$  the density, and  $g$  the acceleration of gravity. Interpreting the expression physically means that the force on any unit area is equal to the weight of the column of liquid directly above it. With the aid of these propositions the explanations of a few known phenomena follow.

**The Hydrostatic Press** consists essentially of a small and large size cylinder fitted with pistons, connected, and filled with some liquid, usually water or oil. (Figure 1.) Let a force  $f$  be exerted downward on the small piston whose area is  $a$ . The pressure is  $p=f/a$  and is transmitted equally and undiminished to each unit area of the large piston whose area is  $A$ . The upward force on the large piston is  $pA$  or  $fA/a$ . The force on the large piston may be made very large by making the ratio  $A/a$  very large. Enormous forces in the industries are obtained by the use of the hydrostatic press. It is to be noted that there is no violation of the Law of Conservation of Energy. The large piston lifting a load does work equal to that done by the small piston in the ideal case. The distance moved by the large piston is the fraction  $a/A$  of the distance moved by the small piston.

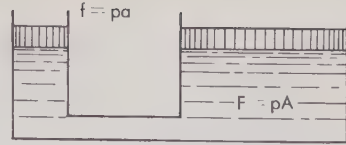


Fig. 1 Hydraulic press

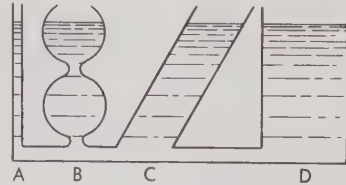


Fig. 2 Hydrostatic paradox

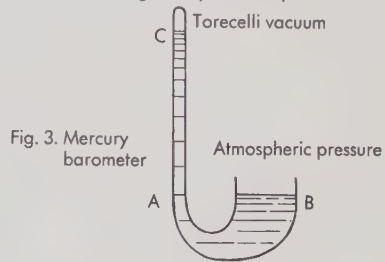


Fig. 3. Mercury barometer

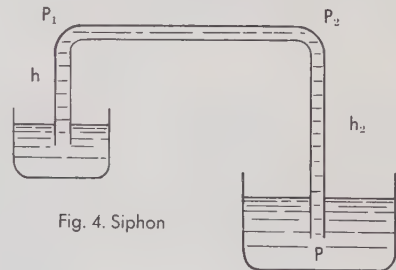
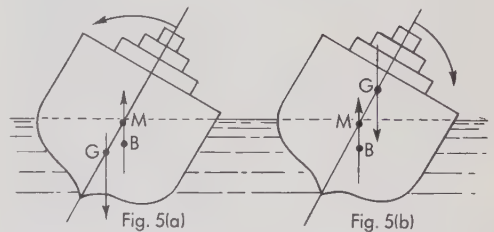


Fig. 4. Siphon



G. Center of gravity B. Center of buoyancy M. Metacenter

**The Hydrostatic Paradox.** Consider a system of large receptacles indicated in figure 2. They may be of any shape whatever and connected horizontally for convenience by a tube. When the system as a whole is filled with a liquid, it will be found that the heights of liquid are the same for all. The pressures at the points A, B, C, and D on the same level will be the same, and hence the heights of the columns above them will be the same. (Proposition IV.)

**The Barometer.** Consider a glass system, as indicated in figure 3, filled with mercury with levels at C and B. The process of filling the system requires care in that the air pressure above C should be as near zero as conditions will permit. This region is known as the Torricelli vacuum. The barometer normally is constructed of uniform tubing rather than as indicated in the diagram, where nonuniformity is purposely exaggerated to indicate that the levels B

and C will be the same no matter what the shape of the system.

The pressure at B is atmospheric, and since A is at the same level, it must also be at atmospheric pressure. (Proposition III.) The difference in level between C and B or C and A indicates the air or barometric pressure, usually shown in centimeters or inches. The pressure in pounds per square inch may be computed easily from the following expression:

$$p = \frac{13.6 - 62.4h}{1728} \text{ where } h \text{ is the difference in level}$$

in inches between C and B. 13.6 is the specific gravity of mercury compound to unity for water; 62.4 lbs. per cubic ft. is the weight of water. There are 1,728 cubic inches in a cubic foot.

**The Siphon.** The description of the siphon is appropriately a problem in hydrokinetics, since it is used to establish a liquid flow. Consider the glass system indicated in figure 4. It is necessary that one liquid level be lower than the other. Both liquid surfaces are subjected to the same atmospheric pressure. The pressure at  $p_1$  is greater than at  $p_2$ , since the column below  $p_1$  is longer than the column under  $p_2$ . The pressure at  $p_1$  is  $p - h_1dg$  and that at  $p_2$  is  $p - h_2dg$ . The difference in pressure is  $p_1 - p_2 = (h_1 - h_2)dg$  and obviously forces the liquid between  $p_1$  and  $p_2$  toward  $p_2$ . If metric units are used, that is, if  $h_1$  and  $h_2$  are expressed in centimeters,  $g$  in terms of centimeters per second per second, and  $d$ , the density, in grams per cubic centimeter, the pressure difference  $p_1 - p_2$  establishing the flow is measured in dynes per square centimeter. If the liquid is water, the pressure difference in pounds per square inch may be computed from the following:

$$p_1 - p_2 = (h_1 - h_2) \times \frac{62.4}{1728}$$

where  $h_1 - h_2$  is measured in inches.

**Archimedes' Principle** deals with the buoyant effect of liquids on objects either totally immersed or floating. The principle states that the buoyant force exerted on a body fully or partially immersed in a liquid is equal to the weight of the displaced liquid. In case the body weighs more than the displaced liquid, it will sink no matter what the depth, providing the displaced liquid is incompressible. If the body weighs less than the displaced liquid when it is totally immersed, it will, when released, immediately rise to the surface and float with a portion of its volume under the liquid to the extent that the weight of the liquid displaced equals the weight of the body. The weight of a ship is expressed in tons displacement. See ARCHIMEDES.

**The Stability of Floating Bodies** is an important factor in ship design. What conditions must prevail in order that a ship will or will not capsize? Figure 5a indicates the position of a ship at a particular instant. The center of gravity (G) of the ship is somewhere along the line of symmetry and is fixed relative to the ship. The buoyant force of the water acts upward through a particular point (B) known as the center of buoyancy. It is the center of gravity of the water which occupied the displaced volume. The force of gravity acts downward through the center of gravity. The figure indicates that these two forces acting on the ship will tend to bring it to an upright position. It is also noted that the line indicating the upward buoyant force intersects the line of symmetry of the ship. The point of intersection is known as the metacenter, and the ship will not capsize as long as the metacenter remains above the center of gravity of the ship. Figure 5b shows the position of the metacenter below the center of gravity of the ship, a condition which prevails when the ship overturns.

**The Diving Bell** offers an illustration of the application of the propositions of hydrostatics to a gas (air) as well as to a liquid. The bell is a chamber closed at the top and open at the bottom and of such

a mass that when immersed with the entrapped air, the buoyant force is less than the weight of the bell. As the bell is lowered deeper and deeper below the surface, the pressure of the entrapped air increases. The air volume decreases in accordance with Boyle's Law, which states that the volume of air gas varies inversely with the pressure when the temperature remains constant. The law was originally set forth by BOYLE in 1660 in a curiously titled book, "A Defense of the Doctrine Touching the Spring and Weight of Air." For most everyday purposes this law is sufficiently rigorous, but as the critical temperature is approached, the deviations become more and more pronounced.

B. J. SPENCE

**HYDROTHERAPY.** See BATH; PHYSICAL THERAPY.

**HYDROTROPISM**, the movement of plant organs, especially roots, toward the stimulus of water. Roots in soils frequently bend and grow toward more moist regions of the soil. Such movements are the result of differences in the rate of growth of cells on opposite sides of a root, the bending occurring away from the side of more rapid growth. Hydrotropism is often responsible for the stoppage of drainage pipes; roots grow toward the damp areas in the vicinity of cracks or holes in the pipe, extend through the holes into the cavity of the pipe, and then branch profusely, shutting off the flow of water. The roots of cottonwood and willow trees are common offenders in this respect.

H. J. FULLER

**HYDROXIDE**, a chemical compound which consists of an element or radical combined with one or more hydroxyl radicals (OH), as sodium hydroxide, NaOH. See HYDROXYL RADICAL.

**HYDROXYGLUTAMIC ACID.** See AMINO ACIDS.

**HYDROXYL ION.** See ACIDITY AND NEUTRALIZATION; BASE; ION.

**HYDROXYL RADICAL**, a combination of one atom of oxygen and one atom of hydrogen (OH) which acts as a unit in chemical change. This radical is a characteristic part of bases, as sodium hydroxide (NaOH), and of alcohols, as ethyl alcohol (C<sub>2</sub>H<sub>5</sub>OH). It is also present in other compounds such as basic salts and phenols. See BASE; ALCOHOLS; PHENOLS.

**HYDROXYLAMINE** is a colorless, low-melting solid; explosive when heated. It has the formula NH<sub>2</sub>OH and, like AMMONIA, has alkaline properties. Its salts are stable and are used as REDUCING AGENTS and in organic synthesis.

**HYDROXYPROLINE.** See AMINO ACIDS.

**HYDROZOA**, a class of the phylum COELENTERATA. Like other coelenterates, the members of this class are radially symmetrical, are composed of two layers of cells (ectoderm and endoderm), and have stinging cells. Digestion is carried on within an internal gastrovascular cavity; respiration and excretion are accomplished through the body surface. Both asexual and sexual reproduction occur, ALTERNATION OF GENERATIONS being common.

Hydrozoans are for the most part marine animals; a few, however, such as *Hydra*, live in fresh water. There are both solitary individuals and plantlike colonies, sessile, or free-swimming. Hydrozoans are typically of two forms, polyp and medusa. *Polyps* are tubular individuals which are attached at one end and free at the other, the free end bearing tentacles. They are produced from the colonial stalk by budding, and as they grow, become specialized either for feeding or reproducing. Reproducing polyps give rise to medusae, which break away from the colony. The free-swimming *medusa* resembles a small, transparent umbrella with tentacles hanging from the edge. It may be either male or female and its chief function is sexual reproduction. Eggs produced in the ovaries of the female medusa and sperm produced in the testes of the male are shed into the water, where fertilization takes place. The fertilized egg or zygote develops into a LARVA which in turn becomes attached and begins to form a new colony of polyps





CHICAGO NATURAL HISTORY MUSEUM

## Spotted hyena of Africa

by budding. The polyps and medusas of the class Hydrozoa are simpler in structure than those of the other coelenterate classes. Representative hydrozoans are HYDRA, Obelia, and the PORTUGUESE MAN-OF-WAR.

**HYENA**, a carnivorous Old World mammal that resembles the dog in appearance but is structurally related to the mongoose. The front of the body, with its broad head, heavy shoulders, and stout forelimbs, is strongly developed, whereas the hindquarters are weak. This ungainly structure probably accounts for the animal's skulking movements. The teeth of the hyena are tremendous and are set in massive jaws, thus enabling the animal to crack the large bones of the dead animals on which it feeds. Although primarily carrion feeders, hyenas have been known to attack sick people and children.

Several kinds of hyenas are found in Africa and Asia, the best known and most powerful being the large spotted hyena, *Crocuta crocuta*, an African species that ranges south of the Sahara. It hunts in packs, frequently roaming through native villages at night in search of offal and dogs, and is noted for its weird and frightening call. The cave deposits of Europe have yielded remains of a larger form of the spotted hyena. A second species, the striped hyena, *Hyena hyaena*, occurs throughout peninsular India and North Africa. Remains found in the caves of Europe indicate that this species also inhabited that continent at one time. It is characterized by a prominent mane along the back and is strictly nocturnal, hunting in a solitary fashion for carrion left by larger beasts of prey. The brown hyena, *H. brunnea*, is another South African form.

L. M. S. W. J. HAMILTON

**HYENA DOG.** See HUNTING DOG.

**HYÈRES**, town, SE France, in the department of Var, about 10 miles E of Toulon and three miles from the Mediterranean Sea. Situated on the Riviera, Hyères is a popular health resort. Its climate is mild and dry, although the mistral is occasionally disagreeable. The town is known for its flowers and early fruits and vegetables. Salt is found near by. The Hyères roadstead is protected by the Îles d'Hyères. Pop. (1946) 23,654.

**HYGIEIA**, in classical mythology the goddess of health, was the daughter of AEscULAPIUS. She was worshiped at Athens, Corinth, Argos, and other important cities, and in works of art is usually represented as a virgin, with a snake, the symbol of health, which drinks from a cup held in her hand.

**HYGIENE** of the body includes a whole range of methods by which the maintenance of good health is encouraged and disease is repelled. It is important to know what constitutes good health practices and what constitutes bad ones. Good personal hygienic practices should become established habits as completely as possible. This is the only way one can avoid thinking about them too much. Hygiene involves a great many aspects of living. The ventilation of the places where people live and work, heating, lighting,

possible contact with industrial hazards, the adulteration and bacterial control of foods, the source of water supply, and exposure to infectious diseases—all are parts of the hygiene that influence individual health. In many of these respects government or other forms of control wield a protecting influence. See HEALTH EDUCATION; COMMUNICABLE DISEASES; PUBLIC HEALTH.

**Diet.** One of the most important aspects of personal hygiene is the choice of food. The diet should contain a sufficient quantity of food to supply the needs of the body but not so much that undesirable fat will be accumulated. Some knowledge of food values is therefore necessary. The three principal types of foods are the fats, carbohydrates, and proteins. Fats supply the largest number of calories or heat-producing units in relation to the total weight of the food substance. The carbohydrates (starches and sugars) also supply large numbers of calories, and can be readily changed into fats within the human body. (See METABOLISM.) Proteins are necessary for proper functioning of the human body but they supply a comparatively small number of calories. Each one of the groups of foods mentioned should be included in the diet every day in order to balance it (see NUTRITION). Likewise the diet must supply minerals, such as calcium and iron, which are necessary for the bones, teeth, and for other structures and functions of the body. VITAMINS too are needed for satisfactory functioning. Not only is it necessary to include the different kinds of food with enough vitamins and minerals, but variety, while it is not so necessary, is extremely desirable. See DEFICIENCY DISEASES.

There must be sufficient roughage in the diet, usually in the form of fruits and vegetables, to aid the action of the digestive tract. This is essential to keep the bowels regular and to prevent CONSTIPATION. The time of eating should be constant; mealtime arguments or quarrels should be avoided as they are known to interfere with the normal flow of digestive juices. Rest for a short period after meals is desirable. Water in small quantities can be taken with meals, but the food should not be washed down. Most of the water taken during the day—and this should be at least six or eight glasses—should be taken between meals. Much of the waste material of the body is eliminated as urine through the KIDNEYS. In order to prevent the accumulation of too concentrated urine enough water has to be taken during the day. The kidneys are susceptible to infection and disease but are remarkably reliable if not mistreated.

**Oral Hygiene.** The care of the mouth, teeth, and gums is part of the hygiene of the digestive tract. (See DENTAL HYGIENE.) The teeth should be brushed twice daily, using a toothbrush that does not cause bleeding of the gums and employing a dentifrice either in the form of a tooth powder or tooth paste. Children should be shown how to brush their teeth in order to dislodge particles of food which otherwise may become the seat of germ growth and cause decay of the teeth. The dentist should be visited once a year, preferably once every six months, so that a small cavity or other difficulty in the teeth can be discovered before serious harm has been done.

**Exercise** is a necessary and desirable part of personal hygiene. The kind and amount of exercise taken must be adjusted to each individual. It is inadvisable to go suddenly from a sedentary life to extremely violent exercises as this throws too great a burden on the muscles, the heart, and other parts of the body. Also the amount and kind of exercises taken should not always be the same for women as for men, though both can enjoy some of the same sports, such as golf, tennis, and horseback riding. Fairly violent physical exertion for a young person who is trained to it seems to do little if any harm. But as a person grows older he should choose less strenuous activities. Individual differences determine what exercise is advisable, but everyone should take enough exercise to keep in good health.

**Care of the Skin** is of great importance to personal hygiene. The skin is more than just a protective coat of the body. It contains sweat glands that empty moisture on the skin in hot weather, which helps the body to keep cool (see **BODY TEMPERATURE**). The oil glands in the skin keep it loose and pliable. Overheated rooms or wearing too heavy clothing or improper clothing may interfere seriously with the normal function of the skin. Clothing delays the loss of heat; some fibers, such as woolen, retain heat much more than others, such as cotton. Rubber clothing, although having special uses, is not porous and entirely prevents normal evaporation of moisture from the skin. The clothing, therefore, should be chosen with care, bearing in mind the type of weather which it is meant to serve.

The skin should be cleansed at frequent intervals. It is considered desirable to bathe daily, not only because of the cleansing action but also because of the stimulating effect on the circulation and on muscles and nerves in the skin. A bath with water temperature of about 96°–100° F. is usually considered the most desirable. Sunlight in moderation is good for the skin, as well as for the body as a whole. Sun rays on the skin produce vitamin D, which is absorbed into the body and is extremely important in maintaining good health. This vitamin prevents a disease called rickets in children, which produces soft bones and bowed legs.

**Eyes and Ears.** Vision is precious. Close work in inadequate light may produce eyestrain and serious disturbances of vision and should be avoided. Those who need glasses should not try to employ their eyes too much without obtaining the correction which only glasses can give. Hearing is also important. Exposure to long-continued loud noises damages the hearing apparatus. Defects of the ear, such as a chronic infection, should be treated as early as possible, lest permanent defect in hearing eventually occur.

**Posture** is important. Constant bending over a desk causes some constriction of the abdominal organs and interferes with circulation. Posture exerts an effect on the general attitude toward life, so that poor posture habits once established tend to become worse. It is not necessary in order to have good posture to maintain the same position at all times. Changing the position helps to relieve muscular strain. What good posture really means is that the body is held in the most effective position while standing or sitting. In recent years much has been learned about the value of selecting suitable chairs, desks, and seats, so that the sitting posture of most people, especially children, is vastly improved over the past. See **POSTURE**.

The foot is an important part of posture and affects the general condition. The foot has two arches; if they are broken, they not only may cause pain in the foot itself but can affect the posture higher up and even produce aches and pains elsewhere in the body. Adequate exercise for the feet, such as going barefoot (where this is safe), is desirable. Flat feet are much more common than is generally realized. These can be corrected by suitable arch supports and other measures.

**Coffee, Tobacco, Alcohol.** Although many people seem to drink coffee and tea without serious harmful effects, **CAFFEINE** is a drug, and all doctors agree that these are harmful for some people. The possible harm of tobacco smoking is a question which has not been entirely settled. Tobacco smoking is almost surely harmful to people with ulcers of the stomach and to those with certain conditions involving the blood vessels. Even if it is not harmful to everyone, no one ever seems to have claimed that it is a definitely healthful habit. Views on imbibing of alcohol are somewhat divergent (see **ALCOHOLISM**). Some people claim that alcohol in all forms is always damaging to health. It is certainly true that large quantities of alcoholic beverages, or alcoholic beverages taken

rather continuously over long periods of time, are dangerous. Furthermore, like tobacco, there is no reason to believe that a person who does not take any alcohol whatever is less healthy than one who does; probably the opposite is true.

EDWIN P. JORDAN, M.D.

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**HYGINUS, SAINT.** See **POPE**.

**HYGROMETER**, an apparatus for measuring the humidity of the air, either relative or absolute. Hygrometers are of three kinds—those, namely, of absorption, of condensation, and of evaporation.

Instruments of the first class are made of various fibrous organic substances, such as hair, oatbeard, and catgut, which contract or expand with variations in the humidity of the air. These instruments fail to give reliable consistent readings.

Hygrometers of condensation experimentally illustrate the principle of the *dew point* from which the relative humidity can be calculated.

The hygrometer in most general use is the hygrometer of evaporation, otherwise known as the *Wet and Dry Bulb Thermometer*, or *Mason's Hygrometer*. See **PSYCHROMETRY**; **AIR CONDITIONING**; **HUMIDITY**.

**HYGROSCOPIC SUBSTANCE**, a solid substance which absorbs moisture from the atmosphere without becoming liquid. The absorbed moisture is mechanically held and is not chemically combined in the substance. Sodium nitrate and silica gel are examples of hygroscopic substances. See **DELQUESCENT**.

**HYKSOS**, or **SHEPHERD KINGS**, the 15th and 16th dynasties of Egyptian rulers. See **EGYPT**.

**HYLAS**, in Greek legend, a beautiful youth, the friend of Hercules, whom he accompanied on the Argonautic expedition. On the Mysian coast the Naiads drew him down into the depths of the spring.

**HYMEN**, in Greek, the song sung by the bride's companions at wedding celebrations. From this original significance, it came to be applied to the god of marriage, who is usually represented as the son of Apollo and a muse.

**HYMENOPTERA**, an order of the class Insecta. All members of the order have the first segment of the abdomen rigidly attached to the thorax. Species having the characteristic two pairs of membranous wings have hooks on the anterior border of the smaller hind wings. These hooks (*hamuli*) hold the fore wings and hind wings together. All of these insects undergo complete *metamorphosis* (egg, larva, pupa, and adult). Most of the females have a special organ for sawing, stinging, or puncturing. Many of the species are social, i.e., live in highly integrated groups in which there is a division of labor, and in which there are morphological and behavior differentiations. Some families belonging to the order are: sawflies, *Tenthredinidae*; bumblebees, *Bombidae*; honeybees, *Apidae*; wasps, *Vespidae*; ants, *Formicidae*; and gallflies, *Cynipidae*. See **ANT**; **BEE**.

**HYMETTUS**, a mountain (alt. 3,370 ft.) of Attica, Greece, rising five miles SE of Athens. Since ancient times the vicinity has been famous for its honey and a fine blue-gray marble, used in sculpture and building interiors. There are ruins of ancient monasteries.

**HYMN**, in Greek poetry a song of praise (two Apollo hymns are preserved from Greek antiquity). The early-Christian churches in Syria and Byzantium took over into their service hymn poetry and melodies. Among the oldest relics of the Western church are the Latin hymns of St. AMBROSE, bishop of Milan (4th century), more songlike in meter and tune than the Gregorian declamatory chants. The medieval hymn texts have been collected in some fifty volumes in Dreves' and Blume's "Analecta Hymnica." Between 1400 and 1600 polyphonic treatment of the hymn melodies transformed the popular tunes into elaborate works of art, of which Dunstable, Dufay,



Stoltzer, Palestrina, Vittoria, Tallis, Byrd are the most eminent masters. Palestrina's magnificent and extensive collection of 1589 "Hymni totius anni" marks the culmination of this polyphonic hymn type. With new German texts, the hymns, now called chorales, became the musical fundament of LUTHER's Protestant church service, not only in more or less elaborate vocal settings, but also in thousands of chorale preludes for the organ; both species culminate in Bach. The "Geistlich Gesangbüchlein" of Luther's friend, Johann Walther (Wittenberg, 1524) was the earliest Protestant hymn-book publication. For England and America the well-known and popular hymn tunes did not, after Cromwell's revolution, serve as material for a more pretentious art as in Germany, but retained their primitive status, as plain tunes sung in unison by the congregation. Yet many of these English melodies are of great beauty.

In Calvin's French Reformed church the plain hymn tunes were the only music admitted by the stern founder. To the French psalter transcription in verse by Clément Mariot strong and beautiful anonymous tunes were added in Calvin's first psalter of 1539. The Geneva Psalter of 1562 with the tunes adapted and arranged by Leon Bourgeois has become the authorized music of Calvin's church; the greatest composer of the French Protestant psalter is

Claude Goudimel. See CROSBY, FANNY.

H. LEIGHTENTRITT

BIBLIOG.—C. Douglas, *Church Music in History and Practice* (1937); H. Marks, *The Rise and Growth of English Hymnody* (1937); H. Foote, *Three Centuries of American Hymnody* (1940); G. Jackson, *Story of the Sacred Harp* (1944); H. Smith, *Lyric Religion* (1946).

**HYNDMAN, HENRY MAYERS**, 1842–1921, English journalist, advocate of socialism, was born in London. In the Italian war of 1866 he acted as correspondent for the *Pall Mall Gazette*, when he made the acquaintance of Mazzini and Garibaldi. All his life he was an active agitator for "social remedies," and in 1881 he founded the Social Democratic Federation. Among his numerous works may be mentioned *Indian Policy and English Justice* (1874); *The Text-Book of Democracy* (1881); *Historical Basis of Socialism* (1883); *Socialism and Slavery* (2d ed. 1889), a reply to Herbert Spencer; *Commercial Crises of the 19th Century* (2d ed. 1902); *Economics of Socialism* (1896).

**HYOGO**. See KOBE.

**HYOLITHES**, a fossil occurring in Paleozoic rocks, characterized by a conical tube of flattened or triangular cross section, which is sometimes closed by a lid. Its relationship to other life forms is somewhat problematic, though it should probably be classed with the worms.

**HYOSCINE**. See SCOPOLAMINE.

**HYPATIA**, 350–415, ancient philosopher and mathematician, became lecturer on philosophy in Alexandria, succeeding her father Theon as head of the Neo-Platonic School. She attracted many disciples by her wonderful eloquence and intellectual gifts, among them being Orestes, prefect of the city, and Synesius, afterward bishop of Ptolemais. Upon Cyril's becoming patriarch of Alexandria in 412, Hypatia, according to tradition, was seized, torn to pieces, and burned by a zealous and bigoted mob. She wrote a *Commentary on Diophantus*, an *Astronomical Canon*, and a *Commentary on the Conics of Apollonius of Perga*; but her works were destroyed with the library in Alexandria. She is the heroine of Charles Kingsley's *Hypatia*.

**HYPERBOLA**, in geometry, a double-branched conic section taken at such an angle that both branches of the cone will be cut. (Slicing a cone with a plane parallel to an element generates a parabola; at a greater angle the cut develops an ellipse or a circle.) The limits of possible hyperbolas would therefore be pairs of intersecting straight lines passing through the cone's vertex and lying in the cone's surface, and an infinitely narrow pair of branches lying infinitely close to an element of the cone.

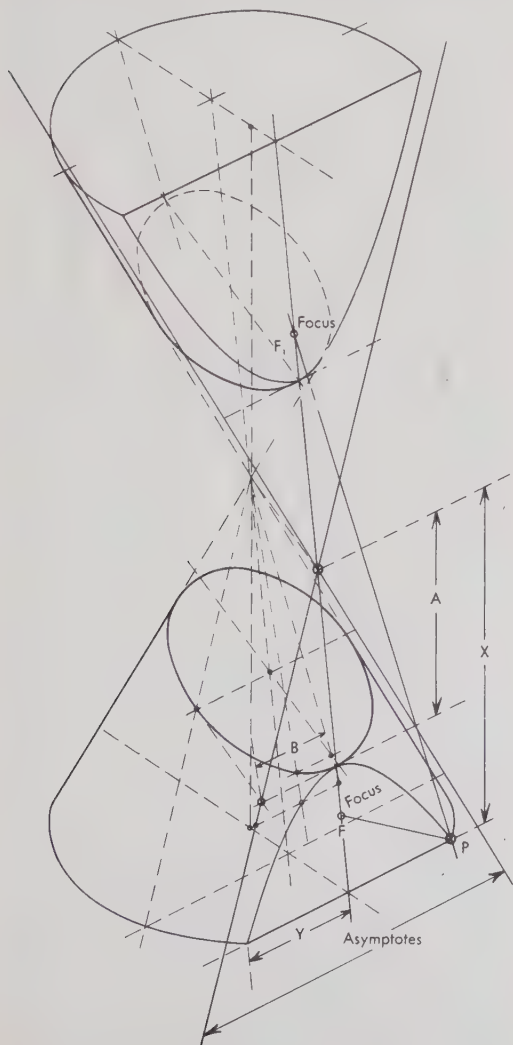
The equation determining the path of the hyperbola as a plane curve is

$$\frac{X^2}{A^2} - \frac{Y^2}{B^2} = 1$$

The definition for a hyperbola is "the difference of the distances from any point on the hyperbola to the two foci is always equal to the distance along the axis between the two branches"; in the line drawing of the hyperbola,  $F_1P - PF = 2A$ . The length B in the equation for the hyperbola is that of the minor radii of the complementary ellipses. If the cut of the hyperbola were parallel to the cone's axis the ellipses would become circles. The hyperbola's asymptotes to which the curves are assumed to be tangent at infinity are straight lines intersecting midway between the two branches and parallel to the elements of the cone's two branches cut at the same angle as that of the hyperbola.

The rectangular or equilateral hyperbola is cut parallel to the axis of a cone having a 90 degree vertex. Such a hyperbola follows the equation of Boyle's Law if the asymptotes represent pressure and volume respectively. See CONIC SECTION; ELLIPSE; PARABOLA; CURVE TRACING; BOYLE'S LAW

**HYPERBOLIC FUNCTION**. See FUNCTION, HYPERBOLIC.



Hyperbola as a conic section

**HYPERBOLOID**, one of the quadric (second degree) surfaces. Hyperboloids are of two types: (1) one sheet, (2) two sheets. The equations for these surfaces may be put in the standard forms:

$$(1) \quad \frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$$

$$(2) \quad \frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$$

The hyperboloid of one sheet has the general shape shown in Fig. 1. It is a *ruled surface*; i.e., a straightedge or ruler may be placed so that the surface touches it along its entire length. Every plane parallel to the XY-plane (i.e., the family of planes characterized by different values of the constant  $k$  in the equation of the plane,  $z=k$ ) cuts, or intersects, the hyperboloid of one sheet in a set (or family) of ellipses. The planes parallel to the YZ-plane ( $x=k$ ) or to the XZ-plane ( $y=k$ ) cut the same surface in hyperbolas. If  $a=b$  in equation (1) the hyperboloid is a *surface of revolution* that may be generated by revolving the hyperbola  $x^2/a^2 - z^2/c^2 = 1$  about the Z-axis.

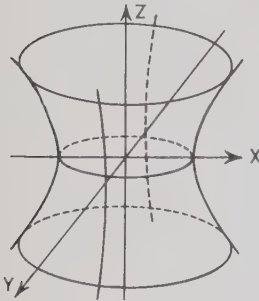


Fig. 1 Hyperboloid of one sheet

of ellipses. The planes parallel to the YZ-plane ( $x=k$ ) or to the XZ-plane ( $y=k$ ) cut the same surface in hyperbolas. If  $a=b$  in equation (1) the hyperboloid is a *surface of revolution* that may be generated by revolving the hyperbola  $x^2/a^2 - z^2/c^2 = 1$  about the Z-axis.

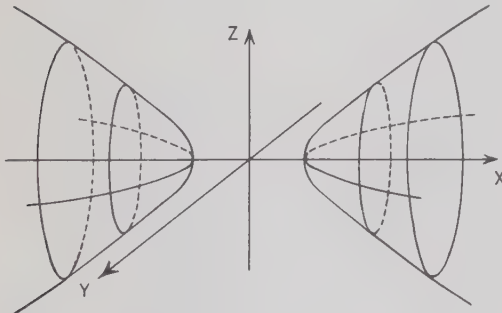


Fig. 2 Hyperboloid of two sheets

The general shape of the hyperboloid of two sheets is shown in Fig. 2. The families of planes for which  $z=k$  or  $y=k$  (for  $k>a$ ), intersect the hyperboloid in ellipses. If  $b=c$  in equation (2) the result is the equation of the hyperboloid of revolution of two sheets.

M. L. HARTUNG

**HYPERBOREI**, mythical people whom the ancient Greeks believed to live "beyond the north wind," in a land of perpetual sunshine, and in perfect happiness.

**HYPEREMIA**. See CONGESTION.

**HYPERESTHESIA** is a morbid over-acuteness of a part of the sensory apparatus, i.e., an increased sensory or neural irritability. All the sensations may be affected by this hyperirritability, but the sense of pain is the one most frequently involved. For example, a patient may complain of areas of pain, or may actually have an increased visual, taste, or auditory acuity. The condition is most commonly associated with **HYSTERIA**, in which case there is no organic basis for the increased sensitivity. Hyperesthesia is also a symptom of various diseases of the sensory centers in the brain or spinal cord, e.g., meningitis, and may be caused by various stimulants and certain toxins. In some instances the hyperesthesia may result from pathological changes in the peripheral or end-organs. In such cases, an inflamed nerve fiber

entering a ganglion may stimulate other nerve fibers entering the same ganglion, thus causing the impulses in the healthy nerves to be experienced as pain.

**HYPERICACEAE**, a family of herbs or small shrubs, rarely trees, principally of temperate and subtropical regions of the Northern Hemisphere. The leaves are opposite and entire, and the flowers are radial, with five, rarely four, petals, commonly yellow, infrequently pink or purple, and have numerous stamens on long filaments, usually joined at their bases into three or five bundles. The genus *Hypericum*, or St.-John's-wort, includes a number of species widely distributed in the native flora of the United States and a number of cultivated shrubs, chiefly of Asiatic and European origin. Some of these shrubs are evergreens. Another genus, *Ascyrum*, includes the St.-Peter's-worts.

H. J. FULLER

**HYPERION**, in Greek mythology, one of the **TITANS**, a son of Uranus and Gaea, and father of Helios, Selene, and Eos, i.e., the Sun, the Moon, and the Dawn. Hyperion is often called the Sun god by the poets and is sometimes identified with Apollo.

**HYPEROPIA** or **HYPERMETROPIA**. See **EYE**, *Disorders of Vision*.

**HYPERSTHENE**, one of the orthorhombic pyroxenes, in composition a silicate of magnesium and iron. With a decreasing proportion of iron, hypersthene grades into **ENSTATITE**. It is golden brown or green in color, and often has a bronzy submetallic luster. It is a common rock-forming mineral, and great masses occur in Labrador and Skye. Hypersthene is found in the norites of the vicinity of Peekskill, N.Y., and is common throughout the rocks of northern New York which extend into Canada.

**HYPERTENSION**. See **BLOOD PRESSURE**.

**HYPERTROPHY**, the term applied in medicine to abnormal growth of an organ or tissue. It may be congenital or acquired. The ultimate causes are often obscure. Congenital hypertrophy is usually unilateral, one side of the body being larger than the other. Acquired hypertrophy may be purely functional, fitting a part for extraordinary work, as in the case of a well-developed muscle. Disease in one organ or part of an organ may cause hypertrophy in another or part of the same organ by throwing extra work upon it. This is complementary hypertrophy, and occurs in one part of the liver when another has become atrophied through pressure or occlusion of the blood supply. Such hypertrophy also takes place in the remaining thyroid tissue after excision of a portion of the gland. Irritation of a part may cause protective hypertrophy. This is seen in the skin, where a callus, or hard thickened covering, results from frequent pressure, and an embedded foreign body such as a bullet, or a bacillus, such as that of tubercle, is often surrounded by a wall of hypertrophied fibrous tissue.

**HYPESTHESIA** is undersensitivity of any sensory area, especially cutaneous. It is often present in hysteria and in some functional psychoses, especially schizophrenia. It may be due to the raising of the sensory threshold by means of drugs. It is a degree of sensitivity somewhat below the normal and above anesthesia.

J. L. HIRNING

**HYPNOANALYSIS** refers to **PSYCHOANALYSIS** under **HYPNOSIS**. Freud and Breuer used it for a time and then discarded it. In recent years, the method has been used again extensively by Brenman, Gill, Anna Freud, Ferenczi, Jones, Schilder, Lindner and others. Anxiety hysteria, hysterical somnambulism, homosexuality, alcoholism, kleptomania, symptomatic asthma, frigidity, conversion hysteria, psychopathic personality, are some of the disorders which have been treated successfully with hypnoanalysis. The method is especially helpful when one deals with a relatively intact ego. It is not only effective, but requires much less time than ordinary psychoanalysis. Whenever resistance is encountered in the use of free association, hypnosis is used to go directly to the source



of the difficulty. The patient is instructed to regress in a trance state to the repressed event or phantasy. He may be asked not only to recall it, but actually to live it again. By post-hypnotic suggestion, he is made to recall the experience in a waking state. The psychotherapist now guides the patient in such a manner that the entire personality can participate in the abreaction.

J. L. HIRNING

BIBLIOG.—R. M. Lindner, *Rebel Without a Cause* (1944); M. Brenman and M. M. Gill, *Hypnotherapy* (1946).

**HYPNOSIS**, a state resembling sleep, characterized by an extreme degree of susceptibility to suggestion and by lack of volition. This condition was first called mesmerism or animal magnetism. Friedrich Franz Mesmer, about 1760, accidentally produced this trance-like state in his attempt to draw out diseases from his patients by what he believed was magnetism. While Mesmer's work was generally discredited his critics admitted that he could effect cures especially in cases of paralysis and convulsions. During the nineteenth century the investigation of this phenomenon was continued by a number of French physicians, especially Jean Martin Charcot. Among those who studied at Charcot's hospital were Pierre Janet and Sigmund Freud; the latter made extensive use of hypnosis in the development of psychoanalysis. James Braid, an English physician, coined the words hypnosis and hypnotism, in 1843, but he preferred the term neurohypnotism. See FREUD, SIGMUND; MESMERISM; PSYCHOANALYSIS.

There has been widespread skepticism of the phenomena of hypnosis among the uneducated as well as among the educated. This is undoubtedly because their enlightenment has been obtained from observations of stage performances which are veiled in mystical rites. Often the process of hypnosis is no better understood by the hypnotist than by his audience. Many people have considered the phenomena to be witchcraft, and thus have considered that its practice should not be permitted. At the present time, though there is much disagreement, many medical practitioners believe that hypnosis is extremely useful in the treatment of many mental disorders.

**Methods of Inducing Hypnosis.** These may be divided for convenience into three groups: (1) visual stimulation, as by the use of a moving object to attract and hold attention, flashing lights, straining the eyes by looking upward; (2) tactual stimulation, such as stroking the forehead and face, touching the eyelids to close them, stroking the limbs (mesmeric passes); and (3) auditory stimulation, as the monotonous repetition of such phrases as, "You feel drowsy; you are going to be hypnotized." It is impossible to say which of these methods is the most effective, as it varies with the patient. In general, all of the methods are combined with the emphasis placed upon the type to which the individual seems particularly responsive. Although hypnosis can be induced in many ways, suggestion in some form is always present.

The usual procedure is to have the subject relax in an armchair or recline on a couch. The operator proceeds by assuring the subject that he is relaxed, feels sleepy, is gradually losing his sensations and—to the extent to which the subject's behavior justifies it—declaring his sensations lost. The same is true in regard to movement. By insisting that the eyelids feel heavy, the operator can influence the subject so as to make him unable to move them. This can be done also with regard to the claspings and unclaspings of hands. Throughout these procedures the aim of the operator is (1) to induce expectation and (2) to get the subject to act in accordance with it.

**Stages of Hypnosis.** Various authors have divided hypnosis into separate and distinct stages, the number of which varies with different authors. These stages are usually referred to as light hypnosis, medium hypnosis, and deep hypnosis—the last characterized by complete amnesia upon waking. This grouping is

in accord with the usual sequence in which they are produced, and most investigators believe that the depth or stage of hypnosis that can be produced varies with the subject. There is an increase in rapport, attention, degree of suggestibility, amnesia, and loss of self-induced thought or volition as the subject proceeds from the earlier stages to the deepest stage of hypnoses.

There is much disagreement as to the physiological changes accompanying hypnosis. An increase or decrease in blood pressure, respiration and heart rate, temperature, digestion, kidney secretion, blanching and flushing of various parts of the body, formation of blisters, increase in the rate of healing of tissue, and secretion of the mammary and sweat glands have been reported. The production of these phenomena has been taken as evidence that hypnosis, as such, has some unique influence upon the nervous system. However, this may not necessarily be the case since most of the above conditions can be brought about through situations in everyday life. Expectancy and increased motivation on the part of the subject may play an important part. It is the opinion of Jenness and Wible that there is no significant physiological difference between the normal and hypnotic state in the absence of direct suggestion.

Hypnosis can have a profound influence upon psychological functions. An increase, decrease, or perversion of the sensations can be easily obtained. With appropriate suggestions, sensations of warmth, cold, touch, and pain will be denied by most subjects. In hypnosis the memory is, as it were, divided into a normal memory of current consciousness, and a hypnotic memory. Fixed ideas are unveiled in relation to forgotten experiences. New fixed ideas can be established often with great permanence, and old ones dislodged or disintegrated.

**Susceptibility.** All people do not respond equally well to everyday suggestion, and hence we would expect that some people would not be easily hypnotized. There have been no facts to support the various theories that women are more susceptible than men, children are easier to hypnotize than adults, weak volition is necessary, or that emotional imbalance such as is found in hysteria favors the process. The success of hypnosis depends upon the subject's previous experience with hypnosis, the prestige and skill of the hypnotist, and upon the method of induction. There have been many proportions given for the susceptibility of subjects, and some investigators believe that individuals vary from time to time in their susceptibility. However, it can be said that practically all, if not actually 100 per cent, of normal healthy persons are susceptible to some form of hypnosis.

There has been no satisfactory answer as to whether people who are unwilling can be hypnotized. There have been cases recorded where subjects have been hypnotized even though they resisted the process. However, we cannot conclude from this that people can be hypnotized against their will, for psychologists know that a subject's statement may not coincide with his actual attitude. The same points can be applied to the question as to whether a subject can be made to perform various acts under the influence of hypnosis which are "against his will."

**Theories of Hypnosis.** Various theories such as neural exhaustion by monotonous stimulation, circulatory changes, sleep-like states, analogies to hysteria, dissociation, and restriction of volition fail to satisfy the numerous points that can be raised. Charcot's theory was that hypnosis is an artificially induced neurosis. He believed that it is closely related to hysteria and that those who are susceptible to hypnosis have neurotic tendencies. Bernheim regarded suggestion as an all-sufficient theory, and that there is no marked difference between normal acts carried out as a result of suggestion and hypnotically induced acts. In all these theories, rapport, or the state of dependence upon the hypnotist, plays an important part, but

it is held by many to be simply the result of expectation or suggestion.

**Uses of Hypnosis.** As a medical device, hypnosis has three major uses: anesthetic, diagnostic, and therapeutic. Hypnosis was used years ago in surgical operations and has been used to a small extent in this country in minor operations. However, there is still a question as to whether pain is present. Some writers believe that the hypnosis is no more real than the anesthesia of a person who has a tooth extracted without the aid of a real anesthetic and says that there was no pain. The German obstetrician Neutra has made an observation regarding hypnosis in obstetrics, and has found that the post-delivery shock is greater following hypnosis than following an anesthetic. On the other hand, the Russian psychologist Bekhterev believed that the usual reactions to pain do not occur with hypnotically suggested anesthesia.

The diagnostic value of hypnosis is more important than the anesthetic. Under hypnosis, a patient is able to recall many past events which are completely hidden from him in the normal state. Thus, the underlying causes of mental difficulties may be uncovered. An extensive use for hypnosis has been found in the neurological wards for the treatment of battle-shocked soldiers during wartime. For example, many persons are unable to withstand the shock of shell fire, and often paralysis, blindness, loss of speech, amnesia, or a combination of these develop because of the strain and fright that occur on the battlefield. If the patient is put under hypnosis, the incident which had been repressed and forgotten when the patient became acutely ill can often be exposed. Once the cause of the disorder is known, therapy can proceed.

Hypnosis is of therapeutic value in many other functional neuroses. Successful results have been recorded in the treatment of hysteria, obsession, stammering, certain neurotic skin diseases, and in melancholia. It is necessary that the basic underlying cause or causes be relieved rather than the symptom—i.e., treatment should be directed to relieve the fear reaction (cause) in war rather than the paralysis (symptom). Unless there is relief of the basic cause, other symptoms of a more severe nature may occur. See PSYCHOTHERAPY; PSYCHOSOMATIC MEDICINE; PSYCHOLOGY; NARCOSYNTHESIS.

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**HYPNOTICS**, also called **Soporifics** or **Somnifacients**, are drugs that produce sleep. In small, moderate doses they produce a state resembling normal sleep from which the individual can be easily roused. In larger, toxic doses they act like anesthetics and bring about loss of consciousness, insensibility to external stimuli (the patient cannot be roused), loss of reflexes, relaxation of the muscles, and finally depression of circulation and respiration. Thus the distinction between hypnotics and anesthetics is not qualitative but merely quantitative. Small doses of hypnotic drugs used during the daytime have a sedative action—they quiet worried or excitable individuals.

The most widely used hypnotics are alcohols, aldehydes, and **BARBITURATES**. Ethyl alcohol is not the only hypnotic that produces a state of "drunkenness"; several other hypnotics are intoxicants even in the sense of making their consumers rowdy or violent. Although the true hypnotics in small or moderate doses are not effective painkillers (analgesics), some physicians call morphine and other opiates *alkaloidal hypnotics* because these drugs may incidentally produce sleep. Such substances, which produce sleep as well as analgesia, are more properly called true narcotics. See **NARCOSIS** and **NARCOTICS**.

True hypnotic agents are used to bring about sleep when insomnia is not due to pain. In larger doses they are also employed as anticonvulsants in strychnine poisoning, in lockjaw, in eclampsia, and even in epilepsy. They are particularly useful, in epilepsy, in

decreasing the frequency and intensity of the convulsive seizures. In mental hospitals hypnotics are often employed to tranquilize patients who otherwise would have to be restrained by more radical means. They are also used to allay a patient's apprehension before a surgical operation and to cut down the amount of anesthetic required for the operation. All these effects are due to cerebral depression by the drug.

**HYPO**, sodium thiosulfate, a transparent crystalline substance used principally in **PHOTOGRAPHY**. The name "hypo" is taken from sodium *hyposulfite*, a name erroneously used for this substance. A concentrated solution of hypo will dissolve the portions of the sensitive silver salts used on photographic films and plates which have not been acted on by light. The solution is known in photography as a "fixing" bath because it fixes the image permanently on the film, plate, or photographic print, by dissolving excess silver salts. The dissolving action of hypo solution on silver chloride is utilized to a limited extent in extracting silver from ores containing silver chloride.

Sodium thiosulfate solution also reacts with the halogens. This property is made use of in the chlorine **BLEACHING** industry. A solution of hypo is used as an *antichlor* to remove excess chlorine from the fabric when the bleaching action is complete. The removal of the excess chlorine is necessary as its presence will weaken the fibers. Hypo solution is also used as an antichlor in the paper making industry.

A solution of sodium thiosulfate reacts with free iodine to form a colorless solution. This reaction is used in quantitative analysis to determine the amount of iodine liberated in a chemical reaction.

Sodium thiosulfate is also used to a limited extent in medicine, in the manufacture of dyes, and in textile dyeing and printing.

Sodium thiosulfate is prepared by digesting sulfur in a solution of sodium sulfite. The resulting solution when evaporated yields hydrated crystals having the composition  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ . E. M. W.

**HYPOCHAERIS**, or **CAT'S EAR**, a genus of composite plants, characterized by strap-shaped florets, an oblong, imbricated involucre; and a feathery pappus. The common long-rooted cat's ear (*H. radicata*), adventive from Europe, bears large yellow flowers at the ends of the branches of the long smooth flower stalk in early autumn. It has bristly, coarsely dentate, radical leaves.

**HYPOCHLORITE**. See **HYPOCHLOROUS ACID**. **HYPOCHLOROUS ACID**, an unstable oxygen-containing acid of chlorine. It has the formula  $\text{HClO}$  and can exist only in solutions, breaking down slowly into hydrochloric acid ( $\text{HCl}$ ) and oxygen. The ability to liberate oxygen has made hypochlorous acid and its salts useful as **BLEACHING** agents and **DISINFECTANTS**.

Hypochlorous acid is formed together with hydrochloric acid when chlorine gas is passed into water. By carefully adding calcium carbonate or sodium bicarbonate, the stronger hydrochloric acid may be neutralized, leaving hypochlorous acid solution. The bleaching action of chlorine water is thus due to the intermediate formation of hypochlorous acid.

Passing chlorine gas into a cold solution of a base, such as sodium hydroxide, results in the formation of salts of hypochlorous acid, called hypochlorites. Sodium, potassium, and calcium hypochlorites are used as bleaching agents and disinfectants because they form small amounts of hypochlorous acid when exposed to air.

**HYPOCHONDRIA** or **HYPOCHONDRIASIS** is a term broadly used to indicate marked or excessive preoccupation with one's body and its functions, usually to be found in a definite personality type.

Hypochondriacs may spend hours at a time studying various parts of their bodies, but most often they concentrate on one or several of the physiological functions associated with their digestive systems, their



respiratory systems, or their hearts and blood vessels. A hypochondriac may be financially successful, and may even enjoy a fair amount of social prestige. However, he feels lost in a crowd, feels isolated even when with others, and is interested only in himself. He is unable to show, let alone feel, real sympathy for anyone else or to understand another's problems. He is constantly on the alert for new nostrums, fads, exercises, or items of clothing which might improve his alleged difficulties.

This type of personality is insecure and immature. He feels inferior, insignificant and oftentimes completely worthless. He is sensitive to the least slight at the hands of others, and will frequently react to such slights with resentment and often with hostility and anger. In the more severe cases of this type, the inferiority feelings may become masked by overcompensatory notions of importance, superiority or even grandeur.

This basic insecurity stems from the early developmental history of the individual. It is related to apparent rejection by either or both of the parents and the remembrance of childhood ill health—especially that related to eating or elimination, which usually led to a show of attention and affection by the parents. Often a repressed sexual conflict is involved. The utter feeling of rejection continues with the individual into his adult years, and results in a continuous shifting of the causes of this condition from the parents to wife or husband, business associates, friends, etc. The response to this reaction by self-preoccupation is also a throw-back to early childhood days when the patient was forced to turn to himself for companionship and comfort. In this way the hypochondriac unconsciously reassures himself that if no one else cares for him he will devote most of his time to himself, and retaliate by not having time to attend to others. Unconsciously he calls for attention and sympathetic understanding by his alleged suffering. Unconsciously, too, he punishes himself for minor sexual misconduct in early youth, conscious hatred of others, or other similar misdeeds regarding which he entertains some feelings of guilt.

Because of the fixity and inflexibility of his notions, the hypochondriac is difficult to treat. Only a physician or psycho-therapist who convinces him after hours of patient listening that he is truly sympathetic and understanding can gain sufficient confidence to give promise of success in readjusting this type of patient. See PSYCHONEUROSIS; PSYCHOTHERAPY.

THEO. J. DULIN, M.D.

**HYPOCYCLOID.** See CYCLOID.

**HYPODERMIC INJECTION.** See INJECTION.

**HYPMANIC STATE** is the mildest state of MANIA and is characterized by disturbances in the fields of affectivity, of stream of thought and psychomotor activity. There is an air of self-assurance, self-satisfaction, and of buoyant self-confidence. The hypomaniac is usually in good humor, is mischievous, boisterous, full of pranks, and indulges in coarse jokes. His attention is easily distracted. His thoughts flow very rapidly and are likely to wander. He is overactive and never seems to feel tired. He is so impatient that everything around him moves too slowly. He finds it difficult to conform to moral standards.

J. L. HIRNING

**HYPOPHYSIS.** See PITUITARY GLAND; ENDOCRINE GLAND, *The Pituitary Gland*.

**HYPOTENSION.** See BLOOD PRESSURE.

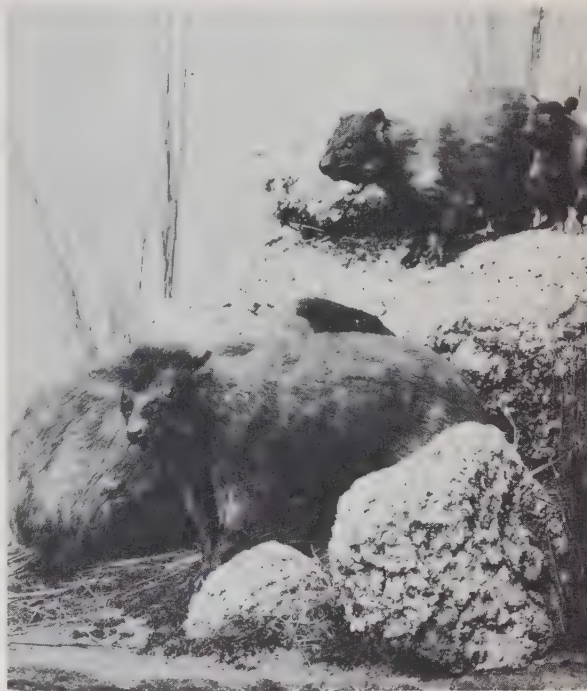
**HYPOTENUSE.** See PYTHAGOREAN THEOREM.

**HYPOTHESIS** may be used widely to signify any supposition; but in the logic of science it signifies a conception or principle supposed in order to explain or bring into intelligible connection a number of given facts whose relations are not clearly understood. When the conception or principle thus supposed is seen to be precisely fitted to explain the facts, the hypothesis is proved or verified, and ranks as an accepted theory of science.

**HYPSONOMETRY.** See SURVEYING.

**HYRACOTHERIUM**, a representative of a family of extinct ungulate mammals, which rank as the oldest and most primitive perissodactyls. Their teeth have short roots, and in their tuberculate surfaces indicate a low degree of specialization. Their fore feet had four toes, the hind feet only three, all of which appear to have been functional and to have reached the ground. The radius and ulna were free and not fixed together. The typical genus is found in lower Eocene beds in England, France, and N. America. Closely related to it were *Eohippus*, *Pachynolopus*, and *Orohippus*, which are believed to be early ancestors of the horse. The existing tapirs appear also to have been derived from this stem.

**HYRAX**, a small, aberrant ungulate, distantly related to the rhinoceros and elephant. Its exact relationship to other groups is still a matter of dispute. Early naturalists considered these animals to be rodents because of a superficial resemblance to rabbits



CHICAGO NATURAL HISTORY MUSEUM

**Hyrax, a rodent-like mammal of the Old World**

and the presence of prominent incisor teeth. The cheek teeth and peculiar three-toed hind feet indicate relationship to the hoofed mammals. Various species of hyraxes occur throughout most of Africa, Syria, and Arabia. The coney of the Bible was undoubtedly the Syrian species. Hyraxes usually live among the rocky cliffs and slopes of mountains. The modified soles of the feet, forming suction cups, enable the animals to climb a nearly vertical cliff surface. All the known species are plant eaters.

W. J. HAMILTON, JR.

**HYRCANIA**, a district of ancient Persia, on the S and SE shores of the Caspian Sea, E of Media, N of Parthia, and bounded on the E by the Oxus (Amu Darya) River. Its chief city was Tape or Zadracarta, the summer residence of Parthian kings. Hyrcania is thought to have been conquered by the Assyrians.

**HYSSOP**, a hardy herbaceous plant belonging to the family, *Labiatae*. Hyssop, *Hyssopus officinalis*, has herbaceous stems springing from a shrubby base; entire, oblong, sessile leaves; and whorled spikes of blue, labiate flowers in summer. It is strongly aromatic, pungent, and bitter; and the leaves are used as flavoring in salads, and also in the manufacture of absinthe.

The dried flowers have a popular reputation as a medicine, and are also used in soups. The herb is easily grown in a light sandy soil, in a warm place.

**HYSTERECTOMY**, the operation of removing the UTERUS, or womb. If the whole uterus including the cervix is removed, the operation is called a complete hysterectomy. If the cervix is left in place, the operation is called a subtotal hysterectomy. The operation may be performed through the vagina or through the abdominal wall.

**HYSTERESIS**. See **MAGNETIC HYSTERESIS**.

**HYSTERIA**, a type of **PSYCHONEUROSIS** in which mental and emotional conflicts express themselves in various physical symptoms; see **CONVERSION**. Some of the symptoms which may be brought on by hysteria are blindness, weakness, paralysis, pain, choking sensations, fever, and convulsions.

The term hysteria is sometimes used loosely to refer to any emotional outburst or tantrum. Such usage is incorrect, for hysteria is a real mental disorder in which the patient has physical symptoms but is totally unaware of the fact that his symptoms are produced by his mental state rather than by some organic cause. Hysteria may sometimes be confused with malingering, in which a disability is purposely simulated.

The typical hysterical personality, exhibiting or tending toward hysterical manifestations, is characterized by a general background of behavior patterns common to all psychoneuroses, and also by certain tendencies usually associated with hysteria alone.

**The Hysterical Personality** is marked by a childish attitude toward life and by an inability to make proper adult adjustments to the conditions of life. Psychologically this indicates a persistence of infantile tendencies. Because he or she is childish, the hysteric is hypersensitive, ingrown, absorbed in himself, impulsive and lacks, sometimes totally, adequate emotional control. He demands attention and if he does not get it, he often resorts to rage and violence. At the same time the hysteric is timid, easily frightened, and is given to unmotivated anxiety. He is very rarely capable of deep love or even lasting friendships; often he feels affection for, and resentment toward, the same person. He is highly suggestible, easily identifies himself with important or famous personages. He indulges in day dreams and fantasies to excess, excluding himself from the actual world. This make-believe tendency often results in excessive lying without cause or excuse. Sexually the hysteric is immature, makes an inadequate wife or husband. The male hysteric is frequently impotent; the woman is inordinately fearful of sex relations. It must be stressed that one or more of these symptoms does not necessarily indicate a hysterical or generalized psychoneurotic condition. The general attitude toward life is, however, most significant.

**Attitudes and Symptoms.** This attitude expresses itself in a tendency to escape from reality, to solve personal problems by means of imagined illness, and to translate personality difficulties into disease symptoms. This last tendency is most important. Often the hysteric exhibits actual physical disability, which generally takes the form of disturbances of visceral function, defections of motility, such as partial paralysis, or hyperkinesis (excessive movement), and sensory malfunction, objective and subjective, such as deafness and hallucination. Hysterical pains are common, and they simulate every known variety of pain. The hysteric will devote considerable time to descriptions and expatiations concerning his pain, doing so with a certain objectivity. Often persons who feel strong moral compulsion to do a task which is beyond their powers of performance will escape the responsibility by developing an occupational disease. The child, for instance, will attempt to escape practicing its piano lessons by complaining of stiff fingers. The adult musician, fearful of failure in his art, will escape censure and social disapproval by developing a partial paralysis of the

arm. Thus the patterns of childhood are extended and intensified by the adult.

**Influence of Early Childhood.** The common forms of hysteria, described here, usually have their source in early childhood. The coddled, protected, spoiled child who has never been properly weaned psychologically may, when at last he encounters the harsh and practical problems of life, become an hysteric. This fact may partially account for the higher incidence of hysteria among women. The girl child is usually more thoroughly protected and secluded from the affairs of life, and for a longer time, than is the boy child. Consequently the girl, badly frightened by early experiences, will tend to run away from life rather than to face it. Hysteria may also appear, however, in the objectively self-reliant and competent individual.

**Treatment Based on Common Sense.** Hysteria, even in its more extreme forms, can be cured. First of all, everything should be done to encourage self-restraint, a sense of security, and an interest in outside affairs. Selfishness, introspection, and idleness must all be guarded against. Particular care in avoiding both emotional exhaustion and overwork is necessary at puberty. Plain food in plenty, outdoor life as far as possible, and active games are most useful in treating the child with hysterical tendencies. Treating the adult is much more difficult and complex. Usually he has his condition so securely rationalized that it is almost impossible to persuade him to adopt healthier habit patterns. Nevertheless, modern psychotherapy, advanced by the researches of Janet, CHARCOT, and FREUD has made considerable progress in the treatment of hysteria. The most effective method is based on common sense. The patient's complaints, his hysterical pains, are taken very seriously by the physician. A meticulous and complete medical and social history of the patient is secured and a careful physical examination made. Everything is done to gain the confidence of the patient. Criticism, indifference, and ridicule have no place in the approach. The patient is constantly reassured about his physical health. After the hysteric is at ease with his physician and when it is clear that the hysteric wants, both consciously and unconsciously, to be cured, the physician may proceed to question the patient, attempting by means of autobiographical detail to reconstruct the submerged pattern which constitutes the source of the difficulty. Often the patient, when he understands the precise nature of his psychic trouble will, with help and encouragement, cure himself. See **FREUD**; **DREAM**; **PSYCHOANALYSIS**.

Although the psychotherapeutic methods have superior effectiveness, medicinal treatment has definite, though limited, value. Narcotics, given carefully, are of some usefulness; but hysterics are prone to addiction, and drugs are administered only as a temporary expedient in extreme cases. The best medicinal treatment is aimed at the regulation of physical malfunctions to which hysterics are susceptible.

The prescription of endocrine extracts can achieve improvement in particular cases, especially when hysteria occurs at puberty or at the menopause. Hypnotism has been used on occasion in attempts to get at stubbornly hidden psychic patterns; but on the whole, each case should have its particular treatment, and medicinal therapy must always be accompanied by psychotherapy.

F. H. S.

**HYTHE**, market town, municipal borough, and seaside resort, SE England, Kent; 67 miles SE of London. It is situated at the eastern extremity of Romney Marsh, on the Strait of Dover. Lympne (*Portus Lemanis*), now inland, was the original harbor which gave Hythe a place among the Cinque Ports. Saltwood Castle near Hythe was once the residence of Canterbury archbishops. Interesting buildings of the town are a Norman church (1750); and a guildhall (1794). There is a six-mile promenade along the sea linking the town with Folkestone. Pop. about 8,600.





**I.** The primary Greek and Latin value of this letter is that in the word "machine" (high front narrow—Murray). Closely related is the short "wide" vowel in "pit" (Murray). In a general scientific notation *i* may include both groups; most modern languages use it to express these values. The sound of the English name is a diphthong, and is a value of *i* quite peculiar to English. It appears from the 15th century. **I**, in Latin, had a consonantal value also, like English *y* (cf. "million," etc.). Other sounds of *i* are not common in English. The Semitic value of *i* was consonantal *y*. Its affinity to *i*, and its tendency to become silent, marked it out for vowel representation in the Greek alphabet. The early Semitic form is like a **Z**, but with a third horizontal stroke in the middle. It quickly simplified itself in the Greek alphabet to its present form. Since the 11th century, first an accent and then a dot have been employed to distinguish *i* from other letters. The same mark is found in Greek MSS., although not employed in Greek printing. The meaning of the Semitic name (*yodh*) and the Greek name (*iota*) is "hand."

In mathematics, *i* represents the imaginary number,  $\sqrt{-1}$  (see COMPLEX NUMBER).

**I.O.O.F.**, Independent Order of Odd Fellows. See ODD FELLOWS.

**I.O.U.**, a written acknowledgment of a debt in which the letters **I.O.U.** are used for the words *I owe you*. The common form is: "To Mr. A. B., **I.O.U.** \$20.—C. D., Jan. 1, 1920." As an **I.O.U.** contains no promise to pay, it is not a negotiable instrument; but it is good evidence of an account stated between the parties.

**I.Q.**, an abbreviation of the term Intelligence Quotient, first suggested by Wilhelm Stern, and first described in this country by Lewis Terman, in 1916, refers to the relation between the chronological age of an individual and his so-called "mental age" established on a test. Mental age had come to be measured on the famous Binet-Simon scale as early as 1905. On this scale, an individual is given a number of problems arranged by age. Each problem is assigned a month-value depending on the number of problems selected for the year. If six problems represent the year, the value of each problem is two mental months. By counting up the mental months earned by the individual for the problems solved correctly, psychologists thus obtain the individual's mental age. Stern and Terman proposed that the ratio between the **M.A.** (mental age) and the **C.A.** (chronological age) could give an **I.Q.** To eliminate possible fractions, Terman further suggested that the ratio be multiplied by 100. Thus the formula for an **I.Q.** became:

$$\text{I.Q.} = \frac{\text{M.A. (in months)}}{\text{C.A. (in months)}} \times 100$$

Thus if an individual's **M.A.** is 120 months, and his **C.A.** is the same, his **I.Q.** is exactly 100. If his **M.A.** is 80, and his **C.A.** is 100, his **I.Q.** is 80. If his **M.A.** is 100 and his **C.A.** is 80, his **I.Q.** is 125. See INTELLIGENCE.

**IACCHUS**, the name of the god Bacchus as worshipped in the Eleusinian mysteries.

**IAMBIC VERSE**, in Greek and English prosody verses composed of iambic feet. The iambic foot is dissyllabic. In Greek the first syllable was long, the second short; in English the unaccented or short syllable stands first, being followed by one which is

accented or long. Iambics are generally used in groups of five, or pentameters, usually without rhyme, when they constitute "heroic blank verse." When rhyming in couplets they are "rhyming heroics." See METER.

**IAMBlichus**, d. c. 330, Syrian Neo-Platonic philosopher, born in Chalcis, Coele-Syria. Little is known about his life, except that he was of noble birth, studied under Anatolius and Porphyry, and was greatly influenced by the philosophy of Plotinus and the mysticism of the Orient. His own philosophy represents a synthesis of Platonic and Pythagorean doctrines, mingled with Oriental mysticism. He maintained that man could commune with the Deity by means of observing specific rites, and also that spirits are able to influence the lives of people and even predict the future. He had many enthusiastic followers. His works include commentaries on the *Dialogues* of Plato and Aristotle's *Analytics*, and *The Philosophy of Pythagorus* and *On the Mysteries*.

**IAPETUS**, in Greek mythology, one of the **TITANS**, son of Uranus and Gaea, and brother of Cronus, Oceanus, Hyperion, etc. He was the father of **ATLAS**, **PROMETHEUS**, **Epimetheus**, and **Menoetius**. After the war of the Titans against the gods he was imprisoned by Zeus in Tartarus.

**IAPYGIA**, the name given by the Greeks to the SE part of Italy, known to the Romans as Apulia.

**IASI**, or **Jassy**, city, NE Rumania, in the province of Moldavia, on the left bank of the river Bahlui, five miles W of the Prut River and 205 miles NE of Bucharest. It is situated on high ground amid picturesque surroundings, and is an important rail junction, with lines running to Galati, Kishinev (Chisinau), Chernovtsy (Cernăuți), and Bucharest. Iasi is the seat of a Roman Catholic bishop and a Greek Orthodox metropolitan. Of the numerous churches, the most magnificent is the 17th century Trei-Erarchi, the "Three Holy Ones." There are three museums, a theater, an art academy, a conservatory, a university (founded in 1860), and several higher schools, institutions which have made Iasi the leading cultural center of Rumania. There is an active trade in cereals, petroleum, salts, metals, fruit, wine, and cattle.

In 1510 Iasi was destroyed by the Tartars, and after 1565 it was the residential city of the princes of Moldavia. In 1792 a treaty was concluded here between the Turks and Catherine II of Russia who was given the territory between the Bug and the Dnestr rivers, thus ending the Turko-Russian conflict. The Rumanian government fled here in December, 1916, after Rumania's defeat in World War I by Germany, and remained until the country's liberation in 1918. In World War II bitter fighting between Soviet and Axis forces took place in and around the city; it was captured by the Soviets in June, 1944. Pop. (1956) 112,989.

**IBA**, city, Philippine Islands, Luzon, capital of Zambayles Province, situated on the Zambayles road, two miles from the China Sea, at the foot of Iba Mountain (5,265 ft.), 85 miles NW of Manila. There are several public buildings, including a high school and a meteorological station. Iba is a center of the rice trade. Pop. 9,741.

**IBADAN**, largest Negro city of Africa, Nigeria, in Oyo Province, the headquarters for Western Provinces, 50 miles NE of Abeokuta, and 123 miles by rail NNE of Lagos. Ibadan is built on the slope of a hill and along the valley of the Ona River, and is encompassed by a mud defense wall some 18 miles in circumference. Native houses are low, with thatched roofs, and there are also European buildings, several

mosques, and *orishas* (idol houses). There are a number of well shaded open spaces within the city and its environs. The chief occupations of the people are agriculture and handicrafts. Ibadan is administered by two chiefs, the *bali* (civil), and the *balogun* (military); disputes among the women are brought to the *iyaloda* (mother). Pop. (1946) 335,500, including the farming suburbs.

**IBAGUÉ**, city, Colombia, capital of the department of Tolima, 65 miles W of Bogotá. Located about 4,300 feet above sea level at the foot of the Quindio Mountains, Ibagué is a market for near-by farmlands producing rice, cacao, tobacco, and sugar cane. Founded in 1550, the city was the capital of the republic for a time in 1854. Pop. (1947) 84,840.

**IBARRA**, town, Ecuador, capital of the province of Imbabura; at the foot of the volcano Imbabura; 50 miles NE of Quito. It long has been a center for a wood carving industry and also markets fine silverwork. Buildings of the city are of typically Spanish architecture. It was founded in 1606 by Cristóbal de Troya, and almost destroyed in 1868 by an earthquake. Pop. (1944 est.) 13,798.

**IBERIA**, ancient name of the Georgian Soviet Socialist Republic.

**IBERIAN PENINSULA**, an ancient name for the region which is now Spain and Portugal.

**IBERIS**. See CANDYTUFT.

**IBERVILLE, PIERRE LE MOYNE, SIEUR D'**, 1661–1706, a French-Canadian soldier and naval commander, the founder of Louisiana. He was born in Montreal, Canada, and was one of the 10 famous sons of Charles Le Moyne. He entered the French navy when a boy; served under Chevalier de Troyes against the English in Hudson Bay (1686); was one of the leaders of the French and Indian force that captured and burned Schenectady, N.Y., in 1690; in command of the *Envieux*, assisted by the *Profond*, defeated two English frigates and captured Pemaquid, Me. (1696); captured all except two of the English settlements in Newfoundland in the winter of 1696–97; and as commander of the *Pelican* defeated three English armed merchantmen (losing his own vessel), and captured Fort Nelson in Hudson Bay in 1697. Sent to establish a French post at the mouth of the Mississippi, he founded Biloxi (near the present Biloxi, Miss.), in 1699, and subsequently a post on Mobile Bay and another on Dauphin Island—thus becoming the founder of Louisiana. He died at Havana, Cuba, while preparing to attack the coast of North Carolina. Of him Parkman has said, "No Canadian, under French rule, stands in a more conspicuous or deserved eminence." See MISSISSIPPI, *History*; ALABAMA, *History*; LOUISIANA, *History*.

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**IBEX**, a wild GOAT found in the mountainous areas of Europe, Asia, and Africa. There are numerous species of ibexes which vary somewhat in color and size. The most common are the Spanish ibex, *Capra pyrenaica*, the Abyssinian ibex, *C. waliae*, the Alpine ibex, *C. ibex*, found only on the Italian side of the Alps, and the Asiatic ibex, *C. sibirica*, of Central Asia and the Himalayas. The Asiatic ibex is the most impressive of the group, standing about three and a half feet high and having 54-inch horns. The horns of the Alpine ibex measure only three feet but are prominently ridged. Ibexes are generally shades of brown or gray, sometimes marked with white and black. The Abyssinian ibex, for example, is dark chestnut in color with gray sides and white under parts. The rocky and precipitous habitat of ibexes, together with their natural agility, makes ibex hunting a hazardous as well as skillful undertaking. See PASANG.

**IBIS**, a group of storklike wading birds belonging to the family *Ibididae*. Most of the birds have a long,

heavy, decurved bill, a naked head, long legs, and a short tail. Situated in front of and drooping down over the tail is a large tuft of soft plumes. Ibises feed on small fish, crustaceans, and other aquatic forms.

The best known member of the group is the sacred

ibis of Egypt, *Ibis aethiopica*. This species is about two feet long. The wrinkled, black skin of the head and neck is devoid of feathers. The body plumage is white, except for the deep purple plumes that comprise the tuft. Because of its long curved bill the Egyptians call the bird Abuo Mengel (Father of the Sick).

There are several American members of the family: (1) the eastern glossy ibis, *Plegadis falcinellus falcinellus*, a bird with chestnut-brown feathers that shade into green, found in the southern part of the United States; (2) the white-faced ibis, *Plegadis guarauna*, similar to the glossy ibis but having a white face, found from Texas eastward to Florida; (3) the scarlet ibis, *Guara rubra*, bright scarlet with black tipped wing feathers, seen only as a straggler from New Mexico eastward to Florida; and (4) the white ibis, *Guara alba*, a white plumaged bird occurring in southern United States from Lower California eastward.

The American spoonbill, *Ajaia ajaja*, is also a member of the family. It differs from the other ibises only in having a straight bill that is expanded at the tip into a broad, flat, horizontally held spoon. This is one of the handsomest of the North American birds. The plumage is pink and the shoulders, rump, and vent-feathers (those around the anus) are deep carmine. It is found from the Gulf states southward.

The large American wood ibis, *Mycteria americana*, is not an ibis but a member of the stork family, *Ciconiidae*. It stands about four feet high and looks very much like the European stork. The bill is long and heavy, the head and neck are covered with wrinkled, black skin, the body feathers are white, and the wing tips and tail, shining metallic black. The wood ibis is most commonly found in the southern states but after the summer breeding season many of the birds wander north for a short period of time and some have even been reported in Maine. The wood ibis is also known as the gourd head or iron head.

L. A. HAUSMAN  
**BIBLIOG.**—F. H. Knowlton, *Birds of the World* (1909); L. A. Hausman, *Encyclopedia of American Birds* (1944).

**ÍBIZA**, or **IVIZA**, Latin **EBUSUS**, one of the Balearic Islands, Spain, largest of the western group, directly E of Cape de la Nao; area about 230 sq. mi.; pop. (1940) 33,961. The climate is mild but dry, and the island is less prosperous than the neighboring islands of Mallorca and Menorca. The principal crops are figs, olives, and vines. Lead is mined, and salt is obtained by evaporation. The capital is the port town, Íbiza (pop. 9,644), which exports figs, raisins, pine timber, and salt.

**IBN BATÛTA**, more properly **Abu Abdullah Mohammed**, 1304–78, Moorish traveler, was born in Tangier, Morocco. He set out along the Mediterranean coast in 1325, visiting cities in Asia Minor, Arabia, and northeastern Africa, and making several pilgrimages to Mecca. He traveled to Iraq, Persia, and Russia; and living for a number of years at Delhi in the sultan's service, was sent as ambassador to the emperor of China. Later he visited Sumatra, Malabar, the Maldives, and Ceylon, returning to his country in 1350. Spain was his next goal, and from there he went to Morocco, the Sahara, and Timbuktu. He dictated an account of his travels, which was translated and edited by H. A. R. Gibb as *Travels in Asia and Africa, 1325–1354* (1938).



White-faced ibis



**IBN EZRA**, more properly **Abraham Ben Meir Ibn Ezra**, 1092–1167, Jewish scholar, also known as **Abraham Judaeus**, **Abenare**, and **Avenara**, born in Toledo in Spain; traveled through Europe, including England (1157–58), and died in the island of Rhodes. In addition to works (in Hebrew) on grammar and philosophy, he wrote commentaries on the Bible—in English trans. *Commentary on Isaiah* (1872) and *On the Canticles* (1874). His mathematical and astronomical works throw much light upon the methods and knowledge of the Arabs in the 12th century. Some of Ibn Ezra's hymns are still used in the synagogue. Robert Browning's poem, *Rabbi Ben Ezra*, was inspired by Ibn Ezra.

**IBN-GABIROL**, **SOLOMON BEN JUDAH**, known as **Avicbron**, 1021–58, Jewish poet, philosopher, and moralist, first Jewish philosopher in Spain, was born in Málaga. His most important philosophical work was the *Fons Vitae*, which assisted in the revival of Neo-Platonism in Europe. Like some other Jewish thinkers (Philo, Jesus, Paul), Ibn-Gabirol's works had more influence on Christian thought than they did on Jewish, and the *Fons Vitae*, although it did not reveal the author's own religion and was long thought to have been written by a Christian, was often quoted by the Scholastics. Affecting medieval Christian mysticism to a great extent, Ibn-Gabirol attempted to explain man's purpose in life, the connection between the soul and a spiritual force responsible for its existence, the necessity of a mediator between God and the world, and a Divine Will which created, conserves, and moves the universe. To matter Ibn-Gabirol assigned supreme importance, it being the underlying force of all being, except God. His *Keter Malkut* (Royal Crown) was introduced into the ritual of the synagogue. R. M. LEONARD

**IBN KHALDUN**, 1332–1406, Arabian historian, was born in Tunis and served several potentates during his lifetime. He was five times *cadi* of Cairo. His chief work was a three-volume history, containing a preface which treated the philosophy of history, a history of the Arabs and their neighbors, and a history of the Berbers. He also wrote an autobiography, completed in 1394.

**IBN SAUD**, **ABDUL AZIZ**, 1880–1953, king of Saudi Arabia, was born in Riyadh, Nejd, but with his father, Abd ur Rahman, and other members of his family had to spend his youth in exile in Kuwait. In 1900 he made the first effort to restore the prestige of the Saud clan by taking Riyadh, capital of Nejd. By 1912 he had conquered all the Nejd and was recognized as the sultan of that state. He did not seek further territorial expansion until 1924, when incensed because Hussein, self-styled "king of all the Arabic countries," had adopted the title of caliph, he advanced with his fanatic followers from the Moslem Wahabis against Mecca and forced Hussein to abdicate. He was proclaimed king of the Hejaz in 1926. After 1932 the dual kingdom of Hejaz and Nejd was known as Saudi Arabia, and Ibn Saud ruled as absolute monarch over the largest Arab nation. He tried to keep his country free from Western progress and modern ideas, but in 1933 granted concessions to United States oil companies for the exploitation of Saudi Arabia's oil-rich lands. From these concessions Ibn Saud received huge revenues. The United States opened diplomatic relations with him in 1940. Ibn Saud was neutral in World War II, and from 1947 joined with the Arab League in opposing the creation of the state of Israel. Theoretically in favor of Arabian independence and unity, he was nevertheless opposed practically to an Arab political federation.



SAUDI ARABIA LEGATION  
Ibn Saud

**IBN ZOHR**, **AVENZOAR**, or **ABU MERWAN**, 1072–1162, Arabian physician, born near Seville, was teacher of physics to Averroës. He wrote the work *Al-Teysir*, considered of the utmost value, by Arab physicians; Latin trans. as *Rectificatio Medicationis et Regiminis* (1490).

**IBRAHIM PASHA**, 1789–1848, viceroy of Egypt, born in Cavalla, Roumelia, adopted son of Mehemet Ali, Turkish viceroy of Egypt. He repressed the Arabs in Upper Egypt (1810), and subdued the revolt of the Wahabis in Arabia. When the Greek war of independence broke out, Ibrahim, in answer to the sultan's appeal for aid (1824), marched into Greece, taking Navarino and Tripolitza, and, after a heroic defense, Missolonghi (1826), but retired after the battle of Navarino (1827). Next, in consequence of a quarrel with the pasha of Acre, he invaded Syria (1831), captured Acre (1832) and Gaza (1837), when the great powers checked further progress. The same thing happened again after the defeat of the Turks at Nisibis, near the Euphrates (1839).

**IBSEN**, **HENRIK**, 1828–1906, Norwegian dramatist, was born in Skien. Except for his studies in the village school and instruction he received as



Henrik Ibsen

apprentice to a druggist at Grimstad, he was mainly self-educated. In 1851, through the influence of the violinist Ole Bull, he was employed as a director in the Bergen National Theater, for which he wrote several immature plays. From 1857 to 1862 he was assistant stage director at the theater in Christiania, producing two historical dramas and *Love's Comedy*, a political satire through which he lost his official patronage. He left Norway in 1863 and spent the following 27 years abroad as a voluntary political exile, settling first in Rome (1864), where he wrote his lyrical dramas *Brand* (1866) and *Peer Gynt* (1867). His first modern prose comedy, *The League of Youth* (1869), was followed by the problem plays *A Doll's House* (1879), *Ghosts* (1881), *An Enemy of the People* (1882) and *The Wild Duck* (1884). His later dramas, such as *Rosmersholm* (1886), *The Lady from the Sea* (1888), *Hedda Gabler* (1890) and *The Master Builder* (1892), were essentially mystic and symbolic. Ibsen was awarded a pension after the publication of *Brand*, but did not resume residence in Norway until 1901. His most significant plays are bold presentations of vital, social problems resulting from prejudice and hypocrisy. A passionate idealist, he constantly stressed two great themes: the maximum fulfillment of individual character and the acceptance of love as the most dynamic factor in that fulfillment. See **DRAMA**; **NORWEGIAN LITERATURE**. J. J. M.

**IBYCUÍ**, city, SE Paraguay, in Quiindy Department, SE of Asunción, in an agricultural region. Pop. (1944 est.) 15,000.

**IBYCUS**, a Greek lyric poet of the sixth century B.C., was a native of Rhegium in Italy, but lived chiefly at the court of Polycrates, tyrant of Samos. His poems treated especially of the subject of love, but only a few fragments are now extant (see Bergk's *Poetae Lyrici Graeci*). Schiller's ballad *The Cranes of Ibycus* is based upon the legend that as the poet met his death at the hands of robbers, he called upon a flock of cranes to avenge his murder; later, as the cranes hovered over the theater at Corinth, one of the murderers, seeing them, exclaimed: "Behold the avengers of Ibycus." This led to an inquiry, and to the conviction of the guilty.

**ICA**, department, SW Peru, on the Pacific Coast; area 9,799 sq. mi.; pop. (1948) 155,794. It is drained by the Chincha, Pisco, Ica, and Grande rivers. The valleys are fertile and produce fruits, sugar cane,

cotton, and cereals. Deposits of copper, salt, coal, and iron are found.

**IÇA**, city, Peru, capital of the department of Iça, on the Iça River, 1,310 feet above the sea; 150 miles SE of Lima. The leading industries are cotton manufacture, distilling, and wine making. Pop. (1948) 68,566.

**IÇA RIVER**, or **Putumayo**, rises in the Andes Mountains of Ecuador and flows SE, forming the border between Colombia and Peru and joining the Amazon in Brazil at Santo Antonio do Iça. During the wet season the river is navigable throughout most of its course of about 1,000 miles.

**ICARIA**. See **SPORADES ISLANDS**.

**ICARIA**, the ideal commonwealth depicted by the French utopian Communist **ETIENNE CABET** and the name of several short-lived Communistic settlements established in the United States during the latter half of the 19th century. Inspired by **ROBERT OWEN**, Cabet wrote his *Voyage en Icarie* picturing a UTOPIA in which all property was to be held in common and all production was to be divided according to need but with the government exercising supreme control over all forms of economic and social activity. The dream of such an Icaria won many converts in France. In 1848 a group of French Icarians emigrated to Fannin County, Tex., where they attempted to establish their Icaria along the Red River. The land was unsuitable, hence the project quickly failed. Almost bankrupt but with some aid from the parent Icarian bureau in Paris, Cabet and his group then moved their project in 1849 to Nauvoo, Ill., which had been abandoned by the Mormons three years previously. The community prospered economically but dissensions arose, caused in part by the dictatorial leadership of Cabet. The colony of French utopians broke up in 1856 with the expulsion of the leader, who died soon afterward in St. Louis; about 200 members followed Cabet and set up a new Communistic settlement at Cheltenham, Mo., which lasted until 1864. Meanwhile some of the others from Nauvoo established another Icaria at Corning, Iowa, where they incorporated in 1860. This community was disrupted by factionalism in 1878, as a result of which two separate communities were set up at Corning, one lasting until 1887, the other until 1898. Still another group under the same inspiration established Icaria Speranza in California in 1883; these colonists became prosperous ranchers and abandoned their communism in 1886. These Icarian settlements were the most successful of the nonreligious communities in the 19th century, being composed of French emigrants who were hard-working, progressive, devoted to education, strict in their family life, and good American citizens while maintaining connections with France. See **COMMUNISTIC SETTLEMENTS**.

F. M.

**BIBLIOG.**—Albert Shaw, *Icaria: a Chapter in the History of Communism* (1884); W. A. Hinds, *American Communities and Co-operative Colonies* (2nd ed., 1908).

**ICARIUS**, in Greek mythology, father of **PENELOPE**, wife of Odysseus. He promised her to the man who should beat him in a foot race; in this contest Odysseus succeeded.

**ICARUS**, in Greek mythology, the son of **DAEDALUS**, who, in spite of his father's warnings when they were flying from Crete with waxen wings, flew too near the sun. His wings melted and he fell into the sea and was drowned.

**ICE**, the solid form which water assumes below a certain temperature. It is crystalline in structure; it has a specific gravity of about 0.92, so that it floats on the surface of water; and it contracts on melting. Ice crystallizes in a hexagonal system and the crystals tend to "twine," giving rise to the delicate patterns seen on frosted windows. Snow, hail, and hoarfrost are the results of the freezing of the moisture in the air.

Water under ordinary conditions freezes at 0° C. or 32° F., but if it is kept perfectly still it may be

cooled to a temperature as low as -6.5° C. (22° F.) and still remain liquid. The freezing point of water and, therefore, the melting point of ice, may also be lowered by pressure, 0.0074° C. for each atmosphere of pressure. It is this characteristic that makes skating possible, the ice melting momentarily beneath the pressure of the skate. High pressures at low temperatures change normal ice (ice I) to other crystal forms denser than water. These are at -10°C.: ice V (4400 atmospheres), ice VI (6300 atm.); at -30°C.: ice III (2200 atm.), ice II (3000 atm.), ice V and VI (at somewhat greater pressure). Salt water freezes at a lower temperature than pure water. See **FREEZING**.

To melt 10 pounds of ice requires the application of as much heat as would raise eight pounds of water from the freezing point to the boiling point. This is usually expressed by saying that the latent heat of water is 80 units of heat, the unit of heat being the amount of heat required to raise a pound of water 1° C. in temperature. No other simple liquid is known to have so high a value for its latent heat.

The change from water to ice and from ice to water cannot be made rapidly, the freezing of the water when the environment is cooling, and the melting of ice when it is getting warmer, having a distinct retarding effect upon the change of temperature which is producing the change of state.

Ice and snow in the making and unmaking are powerful geological or physiological agents. For example, when water which has percolated into the cracks of rocks freezes, it tends by its expansion to force the crack wider, and hasten the disintegration of the rock. The resistless downward motion of glaciers or ice sheets is accompanied by a grinding of the surfaces over which they pass. The rounded forms and striations so produced are unmistakable, and indicate that many lands at present free of ice were in former times covered with extensive ice sheets. See **GLACIAL EPOCH**.

At the present time immense masses of permanent ice occur in the neighborhood of the poles, and on mountains of a certain height in all latitudes. From the polar ice fields and glaciers, great floating masses become detached and form icebergs, floes, and drift ice. See **ARCTIC REGIONS**; **ANTARCTICA**; **GLACIERS AND GLACIATION**; **ICEBERG**.

Ice finds an enormous practical application as a refrigerant, both in industry and in the household, and large quantities of natural ice are yearly harvested for this purpose, cut in blocks, and stored in ice houses for shipment. The manufacture of artificial ice is also an important industry. For the process of manufacture and the applications, see **LATENT HEAT**; **REFRIGERATION**.

R. E. M.

#### ICING ON AIRCRAFT

Aircraft icing is a major hazard, especially in military and commercial flying. Actually, it does not occur very often, but when it does it may be very serious. Normally, an experienced pilot, utilizing all available meteorological data and his own knowledge of terrain and weather, can avoid icing conditions. The problem is aggravated, however, by the fact that when icing is encountered the weather is usually not as forecast. Otherwise the icing area would have been avoided in the flight plan. Thus, icing is usually unexpected.

**How Ice Forms on Aircraft.** Ice formation on an aircraft is caused by the freezing of water droplets which are intercepted by the leading edges of the wings and other exposed surfaces. There are only two fundamental requirements: first, the airplane must be flying through visible water in the form of rain or cloud; second, the temperature of the liquid droplets must be 32 degrees F. or below when they strike the aircraft. Liquid water frequently exists at below-freezing temperatures (see **CLOUD**; **WATER**). This supercooled water is in an unstable state, and when agitated by striking the airplane will freeze.



The heaviest icing occurs when the air temperature is 15 to 32 degrees F. Below the lower limit, it is more likely that clouds will be composed of ice crystals, which do not stick to the aircraft.

**Types.** Two main types of ice form on aircraft, rime and glaze. *Rime* is a granular, frosty crust, generally encountered in stable air, such as that characterized by stratus clouds. White or milky opaque, and granular, it generally has a rough surface, and is formed in clouds composed of small droplets of supercooled water. Rime builds out from the leading edges of wing and tail surfaces, spinners, propellers, and fuselage, sometimes on rivet heads or other parts which stick out into the air stream. It is weak, builds up more slowly than glaze, and can be handled satisfactorily by nearly any type of deicing equipment.

*Glaze* is a transparent or translucent coating of ice which has a glassy surface appearance. It is identical with the glaze which forms on trees, automobile windshields, etc., when freezing rain falls to the earth. Usually met with in rough, unstable air, marked by cumulus clouds, glaze is formed when relatively large, supercooled water droplets, alone or in combination with solid precipitation (snow, sleet, or hail) hit the wing at temperatures slightly below freezing, splash and spread out on the airplane, then freeze. Glaze tends to conform to the airfoil shape, forming a continuous shell, sometimes hard to detect, building back from the leading edges. It builds up fast and is hard to remove.

**Icing Hazards.** The added weight of ice is not its principal danger to aircraft. The principal danger is reduction of the airplane's aerodynamic efficiency, in three ways: (1) decreased propeller efficiency, (2) diminished lift, due to deformation of the airfoil and resulting turbulence, (3) increased drag, due to deformation of the airfoil and resulting turbulence. Ice also makes the aircraft difficult to control and maneuver. Certain flight instruments will give erroneous indications or fail entirely. The decreased propeller efficiency is probably the most serious hazard.

**Carburetor Icing** is usually caused by different factors from those which produce surface icing. Ice can readily form in the throat of the carburetor as a result of the cooling effect of the reduced pressure produced by the Venturi flow of air through its constricted parts and the cooling effect of the rapid evaporation of gasoline into the air stream. Ice usually forms in the supercharger adapter or on the butterfly-type of throttle valve, and eventually closes off the passage of air. Under certain conditions carburetor icing can occur when the air temperature is as high as 80° F., although usually it is encountered only between 20° and 65°, with a high relative humidity, rain or overcast.

Carburetion in aircraft motors has been partly replaced by fuel injection, similar in action to diesel engine equipment. This method avoids vaporization of the fuel before it reaches the hot cylinders of the motor. See FUEL INJECTION.

**Prevention and Removal.** The hazards of aircraft icing are intensified by the fact that it sometimes strikes so swiftly that there is no time to get free of the icing area. There have been many reports of two or three inches of ice deposited on an aircraft in as many minutes. It is thus necessary to have a means of removing the ice quickly, especially on large commercial and military craft. Small aircraft are not expected to be flying in icing weather. *Deicing boots* are installed over the leading edges of the wing and tail surfaces of many airplanes. They are flexible rubber sheets containing inflatable fabric tubes. The tubes inflate and deflate from air pressure supplied to them by pumps. Distorting and stretching of the surface of the boots cracks and loosens the ice, which is then blown away by the airstream. *Thermal anti-icers* use hot exhaust gases to heat air which is passed through ducts to the leading edges of the wings and tail, cabin, and windshield. The hot air keeps the

surfaces above freezing temperatures. *Chemical anti-icing equipment* may work in a number of ways. In some processes it utilizes oil or another surface coating to furnish a nonadhesive surface or lower the freezing point of water. This method has proved practical only on propellers. Deicing fluid, usually glycerine, is pumped from a tank in the airplane to a slinger ring which distributes it to the blades. *Carburetor deicing equipment* includes devices for blowing exhaust-heated air into the carburetor to remove ice, or for spraying alcohol or anilol.

The proper use of all these anti-icing devices is to enable the aircraft to reach a region of no icing, not to remain flying in the danger area. Thus, *pilot technique* is important in preventing ice from forcing the aircraft down. Any maneuvers, such as turns, climbs, or landing, must be performed carefully, with an ample margin of speed to counteract the decreased lift due to icing. Neither technique nor equipment, however, can be expected to overcome severe icing for an indefinite period. The best safeguard of all is accurate weather information so that icing areas can be avoided.

H. L. H.

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**ICE AGE.** See GLACIAL EPOCH.

**ICE BOATING.** The first iceboats were sailboats mounted on runners. The modern iceboat is essentially a sled with a kite-shaped skeleton frame mounted on runners. Iceboats have been used for centuries in northern Europe, primarily for transport on frozen rivers and canals. Most modern iceboats consist of a long slim hull or backbone, a cross member supporting runners at each end, a mast and sail, and a third runner for steering. Early models and most modern craft of large size have two runners forward and the third at the stern connected with a tiller or wheel for steering. Several types of small, speedy modern boats, however, have two runners at the stern and the third, steering, rudder forward. Most skippers maintain three sets of runners for their boats—one for hard smooth ice, one for rough ice, and one for soft, slushy ice.

Ice boating purely for sport seems to have originated in the United States and to have reached its greatest development in the northeastern and north central states and in eastern Canada. Oldest known records indicate that there was ice boating on the Hudson at Poughkeepsie as early as 1790. Another early ice-boating center was Shrewsbury, N.J., where the first modern three-runner boats with mainsail and jib were built and sailed. Lake Hopatcong, N.J., Orange Lake, Lake Champlain, and the bays around Kingston, Toronto, and Hamilton, Ontario, were also early eastern centers.

The early iceboats were hard to steer and control, and designers tended to increase the spread of canvas, thereby making it necessary to increase the weight of the backbone timbers in order to keep the center of gravity low. The *Robert Scott*, built by H. Relyea in 1879, became the model for later builders. It had a single-timber backbone and wire ropes. The lateen rig was introduced in 1900 and resulted in new speed records. Farther west, the lakes of northern Illinois and Wisconsin, Michigan, and Minnesota early became centers of ice-boating activities, including Fox Lake and Calumet Lake in Illinois, and lakes Geneva, Pepin, and Winnebago.

**Racing.** In competition, iceboats are divided into four classes: those carrying 600 square feet or more of canvas; between 450 and 600 feet; between 300 and 450 feet; and less than 300 feet. The so-called "skeeter" boats constitute an additional class and subclass—big skeeters and little ones. Races are usu-



ETHYL CORP.

### Bow-steering iceboat traveling at high speed

ally sailed over 5-, 15-, or 20-mile equilateral triangular courses with two legs to windward. In races involving boats of various sizes and sail spread, the bigger boats are customarily handicapped one second of elapsed time for each square foot of canvas they spread in excess of that carried by the smaller craft. Iceboats under proper handling may develop speeds from 50 to 250 per cent greater than those of the winds driving them. The highest speed recorded in a straightaway run was 140 miles an hour. Other official times ranging from 119 to 125 miles an hour have been recorded. The Northwestern Ice Yachting Association was formed in 1912 to standardize racing rules in the Great Lakes area. The Eastern Ice Yachting Association was organized in 1937.

In 1931 Stark Meyer of Milwaukee built a bow-steered yacht that developed great speed. It was soon demonstrated that bow steering was not practical for larger craft but was ideally adapted to small boats. This led to development, at Lake Geneva, Wis., and elsewhere, of the "skeeter" type of boats from 12 to 18 feet long and carrying from 75 to 175 square feet of sail. The skeeter boats, inexpensive and easily handled, have become highly popular.

**HARRY M. BEARDSLEY**  
**ICE CAVE**, a cave in which there is an annual formation of ice, generally in the late spring or early summer. Ice caves occur in localities having cold winters followed by warm springs. In the United States they have been found in more than 60 different places. Among the most celebrated of the American ice caves are those at Northriver Mills, W.Va.; Manchester, Vt.; Williamstown, Mass.; and Decorah, Iowa.

An ice cave generally communicates with a ramifying system of caverns which extend great distances through the surrounding rock. In the fall, when the earth's temperature is dropping, the air in these caverns contracts, sucking in more air from the outside, as indicated by an inward draft at the mouth

of the cave. During the winter, the air inside the cavern cools to a temperature near the freezing point of water. In the spring, as the earth's temperature rises, the warming of the air in the caverns increases its pressure so that air issues from the mouth of the cave. The sudden expansion of this air as it nears the mouth of the cave causes its temperature to drop sufficiently to freeze the water that has seeped through the walls of the cave. A narrow-throated opening seems to be best adapted to produce this sudden drop in pressure, and it is in the region of this narrow throat that the greatest accumulation of ice is found. The amount of ice varies from year to year, as does the time of its formation. In the Decorah, Iowa, ice cave the month of June is most favorable for the formation of ice. The essential conditions for a good ice cave seem to be a large volume of air, a small opening, and a cold winter followed by a warm spring. C. C. G.

**ICE CREAM**, a dairy product composed of cream, milk, milk solids, sugar, and sometimes eggs. A stabilizer such as gelatin may be included. Ice cream, though commonly served as a dessert, is a nutritious portion of the meal and furnishes essential food elements.

**History.** Ice cream in an early form has been traced to around A.D. 62, when Nero served a fruited crushed ice at a banquet. The basic ingredient was snow, brought from the mountains by runners, and the flavors used were honey, juices, and the pulp of fruits. Marco Polo, on his return from the Far East, brought a recipe for a frozen delicacy using milk which was much like today's sherbet. From Italy, the recipe spread to France, where it was introduced at court. The first "ice" shop was opened in Paris, though the product remained a luxury. Legend has it that the formula was sold to King Charles I for a yearly pension, and the secret was reserved for the use of royalty.

The first mention of ice cream in the United States appears in a letter written in 1700 by a guest of Governor Bladen of Maryland who said, "... we had a dessert no less Curious; among the Rarities of which it was Compos'd, was some fine Ice Cream which, with the Strawberries and Milk, eat Most Deliciously." Advertisements in the New York Gazette in 1777 offered ice cream to the public, and there was an ice cream shop in New York around 1790. President George Washington bought a machine for making ice cream when he was in Philadelphia, and the dessert was a favorite at Mount Vernon. Finally, at the turn of the 19th century, Dolly Madison began to serve ice cream at formal state occasions.

**Manufacture.** When Dolly Madison's servants made the ice cream served at the White House, they had to beat it by hand and shake it up and down in a pan of salt and ice. This was called the "pot-freezer" method. The first improvement in this method was the hand-crank freezer, invented by Nancy Johnson in 1846. Records show that Jacon Fussell started the first ice cream plant in Washington, D.C., in 1851. James Horton and Perry Brazelton were other makers of ice cream who opened plants farther west.

The advent of electricity boomed production of ice cream, which had been made by hand until then. The mechanical refrigerator also helped to make this food available more extensively. In the 1920's the currently used continuous-process freezer was invented by Clarence Vogt. By this method, ice cream mix runs through a tube surrounded with refrigerant. So fast is the method that freezing is almost instantaneous.

**Consumption.** Ice cream is consumed in many forms. Among the most common are the ice cream cone, first introduced in 1904, at the St. Louis World's Fair, and the ice cream bar, first made in 1922. Consumption of ice cream in the United States, which in 1925 was 9.3 lbs. per capita, increased to 15.8 lbs. in 1942 and set an all-time record in 1946, when 22.5





U.S. COAST GUARD PHOTOS

An iceberg in shallow water near shore, left; a huge iceberg floating in the sea, right

lbs. (or 19.1 quarts) were consumed per capita. By 1950, consumption had dropped below 16 lbs.

**Food Value.** The food value of ice cream depends upon the ingredients used. Commonly, other frozen mixtures have been included in the term ice cream. A frappé is an ice or a sweetened, diluted fruit juice frozen to a mushy consistency. Mousse is made from a mixture of whipped cream, sugar, and flavoring. Parfait is a frozen dessert made of whipped cream, eggs cooked with sirup and flavoring. Sherbets are made from the same mixture as ices with the addition of egg white and occasionally gelatin.

True ice cream, however, contains cream, milk solids, milk, sugar and sometimes eggs. It is rich in protein, minerals and vitamins, especially in calcium and phosphorous. Added ingredients, such as fruits, peppermint candy, and nuts lend additional food value when they are present.

ALICE BENNETT

**ICE HOCKEY.** See HOCKEY.

**ICE MANUFACTURE.** See REFRIGERATION.

**ICE PLANT,** a procumbent, succulent plant covered with glittering protuberant dots. All through the summer it bears white, axillary flowers close to the stems. It is easily grown as a half-hardy annual in any well-drained soil, but it must have plenty of sunlight.

**ICE YACHTING.** See ICE BOATING.

**ICEBERG,** a mass of floating ice, broken from glaciers or the ice sheets which cover certain areas in the far north and south. There are three classes of icebergs: (1) the largest and most massive, resulting from the buoyant action of the water as the glacier pushes out into deep water; these usually regain their equilibrium after a little oscillation and float away in an upright position; (2) those which are broken off under water from time to time; and (3) those which form almost continuously, consisting of fragments that separate along the crevasses and fall into the sea.

The size of icebergs varies greatly, but bergs 60 to 100 feet to the top of their walls, with spires and pinnacles from 200 to 250 feet high, are most common. Their length is generally from 300 to 500 yards, and the depth under water is usually about seven-eighths of the entire mass. Most of the Atlantic icebergs come from the ice fields of Greenland, though a small number come from Hudson Bay and from the

Spitsbergen Sea. The greater number are encountered in transatlantic routes in April, May, and June. They have been seen most frequently near the locality where the Labrador current and the Gulf Stream meet (lat. 42° 45', long. 47° 52'). Icebergs have been seen, however, as far south as 39° lat. and as far east as 38° long. See OCEAN.

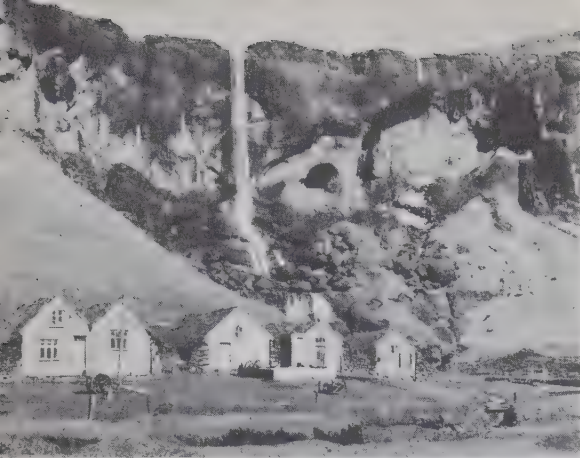
In accordance with an international agreement of 1913, the U.S. Navy Department maintains a patrol of the ice regions for the purpose of spotting icebergs and ice fields near transatlantic lines and reporting their positions daily by radio. See COAST GUARD; TITANIC DISASTER.

E. M. W.

**ICEBREAKER,** a ship of special design and build used in breaking lanes through ice covered water both at sea and on inland waters. The hull about the water line is of extra heavy steel plate with special rigidity at the bow, which is designed to rise over the ice and break through by its crushing weight. Besides the powerful propellers at the stern some icebreakers have propellers forward which churn the water. Without icebreakers many navigable routes would be closed for much of the year, particularly in straits and narrow waters where ice forms more easily. Keeping such lanes open may ensure year-round shipping. Ferrying is frequently an icebreaker's work. The first icebreaker was the tug *Pilot*, built at Kronshadt, on the Gulf of Finland, in 1870. Many and much larger icebreakers have been built since for service in the Baltic and other northern European seas, and the American Great Lakes. The U.S. Coast Guard does notable work with its icebreakers in keeping channels open and in rescue service. See NAVIGATION.

Ice-breaking cutter of the U.S. Coast Guard



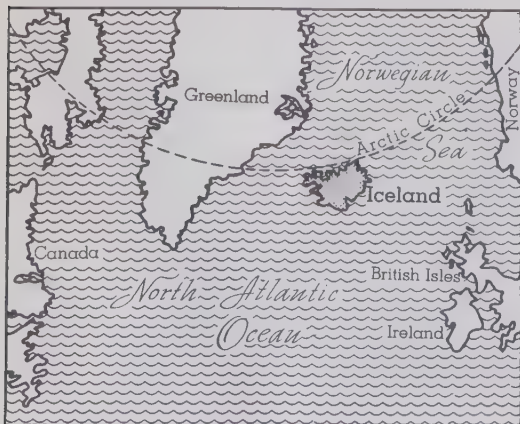


VIGFUS SIGURGEIRSSON

**ICELAND**, a republic comprising an island in the North Atlantic Ocean, its northern tip touching the Arctic Circle, lying 180 miles E of SE Greenland, between 53° 12' and 66° 33' N lat., and 13° 22' and 24° 35' W long.; area 39,709 sq. mi.; pop. (1953 est.) 152,506. Its greatest length is 298 miles and its greatest width 194 miles. Since Iceland lies wholly west of the northeast tip of Greenland, it is a part of the western hemisphere.

**Topography and Climate.** Iceland is roughly oval in shape, with a large peninsular projection to the northwest. There are more than 3,700 miles of coast, a third of which is the deep indentation of the northwest peninsula. The coast is much indented with deep fjords and bays; the inhabited portions of the island are the coastal lowlands and the valleys of the fjords. Most of the surface of Iceland is barren rock, covered in many places by glaciers and local ice caps, or by volcanic and glacial detritus. The productive area comprises fewer than 6,000 square miles, an area about the size of Connecticut, with a soil considerably less rich than that of Connecticut. The mountains range from 4,500 to 6,952 feet, the highest point being Oraefa Jökul. There are a number of lakes; chief among them, Thingvallavatn and Thorisvatn, each about 27 square miles in area. There are many rivers plunging torrentially from the high inland plateaus, their courses interrupted by numerous waterfalls. The most remarkable is the Dettifoss River in northeast Iceland. It has been estimated that the rivers could furnish some 4,000,000 horsepower; only 25,000 is utilized.

More than 20 **VOLCANOES** have been active on the island since Iceland was first inhabited, Hekla being the most active. After an eruption in 1845, Hekla was quiescent for 102 years until March 29, 1947, when it again exploded. The many widely scattered hot springs and geysers are connected with deep-lying volcanic fires. The most famous geyser, Geysir, has



Location map of Iceland

## Iceland

given its name to the spouting hot springs of North America and Australia. Hot water from the springs is piped to heat the buildings of Reykjavik, the capital.

In spite of Iceland's far northern position, the climate is mild, most of the island's shores being bathed in the drift from the GULF STREAM. Although Akureyri, Iceland's second city, is situated in a deep fjord on the northern coast where winter ice piles up, the city has an average temperature of 32° F., with the winter temperatures averaging 20°, and the summer 45°. Reykjavik, on the southwestern coast, has an average temperature of 39°, with January averaging 30°, and the summer 52°. Rainfall varies from year to year, with the heaviest fall in the south. The weather is uncertain, with gales, snowstorms and the infrequent thunderstorms occurring during the winter. There are often mists and fog; yet when the weather is clear the atmosphere is so unusually transparent that a mountain 100 miles distant can be seen distinctly.

**Plants and Animals.** Since Iceland during the Ice Age was completely covered with a thick crust except for a few barren peaks, all existing life is an importation. Animal life that has been brought to the island is of far northern or European origin. The sea life is richly diversified; in the north and east it is arctic like that of the Norwegian Sea, but in the south it is of northern European type like that of the Atlantic deeps. The earlier land animals are a variety of the European field mouse and the arctic fox. Polar bears occasionally come to Iceland on the drift ice from Greenland. Reindeer were brought to the island in 1770, but are not domesticated; they live in the unpopulated districts, and are hunted for their flesh and antlers. Domestic animals include cattle, sheep, the tough Iceland pony, and dogs of the Eskimo type. There are more than a hundred bird types, of arctic and northern European species. The eider duck is the most important bird, and is abundant on the coasts and some of the lakes. Eider duck eggs are eaten, and the eider down is an item of export. Some 700 varieties of insects have been found in Iceland, with the northern two-winged fly predominating among 241 species. Mosquitos are not abundant.

Iceland's vegetation is of the European arctic type, and is distributed throughout the island, including the barren interior. There are 440 kinds of flowering plants; among the smaller ones are buttercups, marsh marigolds, poppies, violets, pinks, vetches, meadow-sweet, the white dryas, saxifrage, and dandelions. Birches are found, especially in the warmer valleys, but rarely grow to more than 3 to 10 feet in height. There are some 20 varieties of dwarf willows, which reach a height of 10 feet. Mountain ash grows singly, and some trees reach 30 feet.

Of much value to Icelanders, are the grasses which provide food for their livestock. Heather, which grows abundantly in several areas, provides pasturage for sheep. Seaweed found on the beaches is also fed to sheep. A lichen called ICELAND MOSS grows to three or four inches in height on the lava slopes and plains of western and northern Iceland, and was once used as food.

**People.** Iceland has been settled since the ninth century, chiefly by people of Scandinavian blood, although there was an early blending of Irish blood. In 1402-04 the Black Death is said to have taken some two-thirds of Iceland's inhabitants. Between 1840 and 1880\* Iceland suffered economically and as a result some 25,000 of its people emigrated to North America, principally to Canada.

### PRINCIPAL CITIES

|                             | POPULATION |        |
|-----------------------------|------------|--------|
|                             | 1943 EST.  | 1953   |
| REYKJAVÍK, the capital..... | 42,815     | 60,024 |
| Akureyri.....               | 5,815      | 7,387  |
| Hafnarfjörður.....          | 3,944      | 5,464  |
| Vestmannaeyjar.....         | 3,524      | 3,980  |
| Keflavík.....               |            | 2,952  |
| Akranes.....                |            | 2,915  |





OSKAR BJARNASON  
Autumn roundup of sheep in Iceland



VIGFUS SIGURGEIRSSON  
Bridge across the Hvita (White) River



VIGFUS SIGURGEIRSSON  
Parliament building in Reykjavik



VIGFUS SIGURGEIRSSON  
Fish market on Siglufjordur wharf



JONSSON & JOSEFSSON  
University of Iceland at Reykjavik



U.S. ARMY SIGNAL CORPS  
Icelandic shipping in Reykjavik harbor

The Evangelical Lutheran church is endowed by the state, but there is complete religious liberty on the island. There is no illiteracy in Iceland. The University was established in Reykjavik in 1911, and has four faculties (theology, law, medicine, and the arts). Lesser schools are conducted by the municipalities and the state, and instruction is free. Elementary school attendance is compulsory between the ages of 7 and 14. A hospital bed is maintained for every 110 people on the island. See ICELANDIC LANGUAGE AND LITERATURE.

**Economic Life.** Farming, which occupies some 36 per cent of Iceland's employables, is largely the cultivation of hay land for the feeding of livestock, although potatoes and turnips are grown for home use. One-fifth of the population is engaged in fishing, which, during the 20th century, has attained great importance through the use of steam trawlers and motorboats. The Icelandic fisheries are extensive and are visited by both European and American fishermen. Chief products of the fisheries are the cod and the herring, which are rigidly inspected by the government before permission to export is granted, so that a high reputation is maintained for the Iceland product. Trade is carried on with the northern European countries. The principal exports are fish and their products, hides, and wool. Among the imports are foods, beverages, tobacco, chemicals, wood, cork, textiles, clothing, machinery, and metals.

**Transportation.** Iceland has no railways or navigable inland waterways. Motor vehicles, coastal steamers, and airplanes are the chief means of transportation. There are more than 4,000 miles of highway. Two domestic airlines serve the island, which is a strategic point on the northern great-circle air route between Europe and America. C. S.

**Government.** In 1944 Iceland became an independent constitutional republic, ending the Act of Union which had united the island with Denmark under the Danish king. Under the revised republican constitution the people elect a president for four years. The ALTHING, which is famous as the oldest legislative assembly in the world, consists of 52 members elected by the people. The Althing elects one-third of its members to the Upper House; the remaining two-thirds constitute the Lower House. Real executive power is in the hands of a cabinet responsible to the Althing and chosen from its membership. The cabinet consists of six members headed by a prime minister. For local administration Iceland has 16 provinces and 10 urban municipalities, each with its town council.

**History.** It appears that the island was first settled about 795 by Irish monks, who abandoned their settlements when the heathen Norsemen or Scandinavian vikings began colonizing Iceland about 870. Later immigrants came from Scotland and Ireland. The first Althing met at Thingvellir in 930 as a general assembly for the whole island, but in spite of this instrument of political unity internal conflicts between the separate settlements continued for hundreds of years. Christianity was introduced about 1000. Iceland was subjugated by the king of Norway in 1261; in 1380 it passed with Norway under the rule of Denmark. After the great period of literary activity during the 12th and 13th centuries the island declined in culture during the following centuries because of disturbed conditions in Europe and a series of natural disasters and epidemics. A revival began in the 19th century. The Althing, which had been abolished in 1798, was restored in 1843. Home rule was obtained in 1874. In 1918 Iceland became a sovereign state, united with Denmark only through a common sovereign; foreign affairs and defense, however, were controlled by the Danish government. When the Germans occupied Denmark in 1940, the British sent troops to Iceland to prevent the Nazis from using the island as a naval and air base. In 1941 Iceland agreed to entrust its defense to the United States as long as

the German threat existed. The United States withdrew its forces in 1946 but was permitted to use the Keflavik airport for civil and military aircraft and to maintain personnel there. In 1949 the island, which had become a republic in 1944, joined the North Atlantic Pact and the Council of Europe, at the same time maintaining close relations with Scandinavian nations. The United States and Iceland signed an agreement in 1951 for use of the island's defense facilities. According to the pact, the Keflavik airport would be used for the country's defense but Iceland would retain control of its civil activities. Iceland was also granted control over the number of troops.

By 1955 U.S. troops stationed at Keflavik and at vital radar installations on the island numbered about 6,000, and Iceland had become a strategic center of the North Atlantic. The United States had spent \$160 million on the installations and facilities, and was planning to spend \$200 million more on a major naval base. Friction between Icelanders and U.S. military personnel, however, was a source of growing dissatisfaction with the presence of the troops on the island. As early as two years after the 1951 treaty, national elections produced a sharp drop in the strength of the Conservatives, and by 1955 pro-Communist parties were gaining strength.

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**ICELAND MOSS**, a LICHEN found in mountainous regions of northern Europe and elsewhere. In Iceland the plant is used as a food. It is ground with flour and added to soups, which it thickens and enriches with starch, or it is powdered and made into bread, or is boiled with milk. It has a bitter taste, which may be removed by soaking it in a dilute solution of sodium carbonate. The decoction may be fermented, and alcoholic liquor produced, from which a spirit can be obtained by distillation. It is also used for dressing the warp in weaving and in manufacturing sizing paper.

**ICELAND SPAR** is a clear, transparent, colorless variety of CALCITE,  $\text{CaCO}_3$ , found in Iceland; sp gr 2.7, h. = 3. It is by reason of its strong double refraction and perfect transparency, pre-eminently suited for optical purposes, particularly in polariscopes and Nicol's prisms.

**ICELANDIC LANGUAGE AND LITERATURE.** The language of modern Iceland is almost precisely the same as that which was spoken in Iceland at the time of its colonization in the ninth century—the ancient Norroena or Old Norse, which closely resembles Anglo-Saxon, and which, the sagas state, was readily understood not only throughout the Scandinavian countries, but also in England.

**Medieval Literature.** The literature of Iceland, like that of Norway, counts two periods of remarkable activity—the first from about the middle of the 11th to the end of the 13th century, and the second from the beginning of the 19th century to the present time. The literature of the older period shows three stages of development—the ancient mythical and heroic songs; the works of the SKALDS, or court poets; and the sagas. The early mythic songs, as *Völuspá* ("The Wise Woman's Prophecy"), *Hamarsheimt* ("The Quest of the Hammer"), and *Hymiskvida* ("The Lay of Hymir"), were written from 800 to 1100 and were later collected in the *Elder Edda*. Among the most notable of the skaldic poets were the warrior Egil Skallagrímsson (940–90), famous for his lament for his son; Eyvind (910–95), the skald of Hakon the Good, king of Norway; Kormak (937–67); Hallfred the Troublesome (968–1014); and Sighvat Thordarson, the friend of the Norwegian kings Olaf and Magnus.



## Ichang

The prose SAGA, however, is the peculiar and crowning product of Iceland's literary genius. The saga grew out of the Icelandic storytelling tradition. Among the host of tales written during the richest period of the saga (1150–1300) the following are the most notable: the *Gylfaginning*, *Njals saga* ("The Story of Burnt Njal"), *Egils saga*, the *Laxdaela saga*, and *Grettis saga*. The epic *Volsungasaga* differs from these in that it is purely mythical. The chief sources for medieval Icelandic literature are the collections known as the *Elder Edda* and the *Younger Edda*. The latter, which comprises the mythical-heroic sagas, was compiled about 1222 by SNORRI STURLUSON (1178–1241), whose own cycle of sagas, the *Heimskringla*, provides a valuable chronicle of the kings of Norway. The *Elder Edda*, in which the old mythic songs were preserved, is traditionally attributed to Saemund, who flourished about 1100. See EDDA; VOLSUNG SAGA. The relatively barren stretch between the medieval and modern periods can furnish the names of only a few minor poets—Stefan Olafsson (1620–88), Hallgrímur Petursson (1614–74), and Eggert Olafsson (1726–68)—and of such scholars and chroniclers as Finnur Jonsson (1704–89), who wrote in Latin a four-volume history of the church in Iceland. The last significant figure in the Dark Ages of Icelandic literature was Jon Thorlaksson (1744–1819), a country curé. He produced some original verse, but is best known for his translations of Milton, Pope, and Klopstock which showed that Icelandic retained its old power and plasticity as a poetic medium.

**The Modern Period.** The influx of Continental Romanticism and the rapid growth of national consciousness produced a vigorous renaissance, which first appeared about 1830. The most important organ was the magazine *Fjölnir* (1835), which featured the poetry of Bjarni Thorarensen (1786–1841), Jonas Halgrimsson (1807–45), and other pioneer romanticists. Iceland's first novelist, Jon Thoroddsen (1819–68), also belonged to this early romantic generation. About 1880 romanticism began to give way to a native realism, represented in the novels and short stories of Gestur Palsson (1852–91), and Einar Kvaran (1859–1938), leaders of a literary group known as the *Verdandi*. Other distinguished figures in the 19th-century renaissance were Jon Sigurdsson (1811–79), the historian; Finnur Magnusson (1781–1847); Gudbrandur Vigfusson (1827–89), and Sveinbjörn Egilsson (1791–1852), all philologists; the folklorist Jon Arnason (1819–88); and Thorvaldur Thoroddsen (1855–1921), who wrote on the geography of Iceland.

The greatest achievements of contemporary writers have been in the field of fiction, especially in the short story. Kristmann Gudmundsson (1902– ), particularly, has succeeded in recapturing the color and vitality of the old sagas. Notable novelists are Gunnar Gunnarsson (1889– ), whose chronicle novel, *Guest the One-Eyed* (1912–14), was popular in English translation, and Halldor Kiljan Laxness (1902– ), who sought to express the essential nature of the islanders in such novels as *Independent People* (1934–35), *The Bell of Iceland* (1943), and *The Fair Maiden* (1944).

**ICHANG**, an important port, S central China, in Hupeh Province, on the Yangtze River, 965 miles W of the East China Sea and 300 miles E of Chungking. Strategically Ichang is the gateway to Chungking, serving as a trading port for Szechwan Province, the city of Hankow, and the Yangtze Valley. The larger steamers bring cargo to and from Szechwan Province to Ichang, highest point of navigation for larger boats on the Yangtze. Ten miles northwest of Ichang are the famed, rugged gorges and dangerous rapids of the Yangtze. Their spectacular beauty has been celebrated by Chinese poets for centuries. Plans have been made to harness the river at Ichang with a mammoth dam or a series of dams to back up the Yangtze 350 miles west to Chungking, thus providing irrigation for 10 million acres of potentially productive land. The project includes construction of a hydroelectrical



BURTON HOLMES-EWING GALLOWAY

### Shipping at Ichang on the Yangtze River

plant and locks which will enable large vessels to sail up the Yangtze as far as Chungking, 1,000 miles inland.

Ichang was bombed frequently during the Sino-Japanese phase of World War II. The city was the farthest point into central China reached by invading Japanese troops and fell on June 11, 1940. In August, 1945, after the Japanese surrender to the Allies, Chinese troops reoccupied the port. When the Japanese seized the city it had about 300,000 inhabitants. Pop. (1947 est.) 100,000.

**ICHINOMIYA**, city, Japan, Honshu, Aichi Prefecture, situated 10 miles NNW of Nagoya. During World War II it was about half destroyed by American superfortress bombs. Pop. (1946) 58,441.

**ICHNEUMON FLY**, a parasitic wasp belonging to the family *Ichneumonidae* of the order Hymenoptera. These cosmopolitan insects, generally found in forested areas, are exceedingly numerous, about 6,000 species having been identified in the United States alone. They vary in size from minute species a few hundredths of an inch long to species as long as four and a half inches. Most of them have a long, slender abdomen and large wings. The ovipositor of the female may sometimes be twice as long as the entire body. These insects are parasites of other insects, often of agricultural pests. The largest of the ichneumon flies, *Megarhyssa*, is a parasite of the wood-boring larva of the pigeon horntail, *Tremax columba*, which infests orchards. By devious means the ichneumon fly deposits an egg in the burrow of the *Tremax* larva. The fly larva emerges and feeds upon the *Tremax* larva, killing the latter. It then undergoes pupation and when the adult form is reached leaves the burrow. Members of another tribe of ichneumon flies lay their eggs on spiders. The larvae that hatch feed upon the spider, eventually destroying it. Other species of ichneumon flies deposit eggs within the host. L. M. S.

**ICHTHYOLOGY**, the branch of zoology that is devoted to the study of FISH.

**ICHTHYOSAURS**, extinct reptiles of the order Ichthyosauria. These porpoise-like animals, ranging in length from 2 to 35 feet, began in the Triassic period and lived until almost the end of the Cretaceous. (See GEOLOGIC TIME.) That they were perfectly fitted for their marine environment is shown by many structural adaptations of the body. The jaws were long and beaklike, and contained numerous small, sharp teeth used for grasping fish and marine invertebrates, which served as food. Rings of bony plates protected the large eyes against the effects of changes in water pressure. The neck of the ichthyosaur was extremely short and probably quite inflexible, as is the case in many other animals which are adapted for rapid swimming.

Swimming paddles replaced the limbs of the ichthyosaur. The bones of the limbs were short; those of the feet resembled flat, polygonal disks, set close together. A tendency toward an increase in both the number of digits (*hyperdactyly*) and the number of joints in each digit (*hyperphalangy*) is observed in these animals, some species having as many as eight digits in a paddle.

Further adaptations of the ichthyosaur to a marine environment are shown by the streamlined, laterally-compressed body, and by the dorsal fin, a structure which has never been found in any other reptile.

In the earliest known ichthyosaurs, the tail was long and narrow, and was probably not a very powerful swimming device. Later forms, however, had tails resembling those of sharks, but with an extension of the backbone into the lower lobe rather than the upper lobe. Such a tail must have been the chief organ of propulsion, and in these later ichthyosaurs the paddles were probably used only for balancing and steering.

Carbonized impressions of the skin indicate that the ichthyosaurs were unarmored, except for small scales which were present, in some species, on the front of the paddles and along the dorsal edge of the body. Skeletons of embryos which have been found inside the body cavity of some specimens, show that the young were born alive.

H. E. KOERNER

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**ICKES, HAROLD L.**, 1874–1952, American lawyer and public official, was born in Frankstown Township, Pa., and studied at the University of Chicago. He practiced law in Chicago and was prominent in city politics, earning for his stand against political graft the title of “gadfly of Cook County.” An independent, Ickes was active in several political campaigns but was consistently unsuccessful. He was appointed secretary of the interior by President Roosevelt in 1933, and served as head of the Public Works Administration from 1933 to 1939. During World War II his responsibilities included the co-ordination of petroleum, of solid fuels, and of fisheries, and the administration of coal mines. He resigned from the cabinet in February, 1946, after a dispute with President Truman over the appointment of Edwin Pauley as undersecretary of the navy. Ickes wrote: *The New Democracy* (1934); *Back to Work* (1935); *America's House of Lords* (1939); *The Third Term Bugaboo* (1940); *Freedom of the Press Today* (1941); *Autobiography of a Curmudgeon* (1943); *My Twelve Years with F.D.R.* (1948).

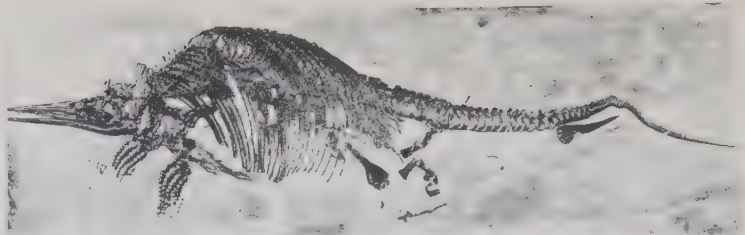


Harold Ickes

**ICKNIELD STREET**, one of the earliest known roads of Britain, claimed by many to have been even prehistoric, running from Cornwall through Berkshire and through the Chilterns and crossing the Thames near Streatley and on to London, ending somewhere in Norfolk. Some authorities consider Icknield Street the Saxon name for the road; others consider it the Roman name for the highway through the land of the Icenæ (Celts).

**ICOLMKILL**. See **IONA**.

**ICONIUM**, modern **Konya**, ancient city in Asia Minor, situated on the principal military and commercial highway. Originally a Phrygian city, it was



Ichthyosaurus skeleton with embryos of unborn young

AMERICAN MUSEUM OF NATURAL HISTORY

added to the Galatian country about 165 B.C.; and formed part of the Roman province of Galatia from 25 B.C. to A.D. 295, when it was annexed to the province of Pisidia. In 372 it became part of the province of Lycaonia, and later of Anatolia. Iconium appears to have been an important Christian center, and many ecclesiastical remains of early date have been found. It was three times visited by Paul and Barnabas (Acts 13, 51; 14, 1–6; 14, 21). A synod of the church was held there A.D. 235. The Emperor Claudius granted to the city the title of “Claudiconium,” and Hadrian raised it to the rank of a Roman colony. About 1074 it fell into the hands of the Seljuk Turks; in 1079 was made the capital of their kingdom; and for a time enjoyed great splendor and prosperity. The town played a prominent part in the Crusades, being occupied by Godfrey of Bouillon, and by Frederick Barbarossa (1190). Here Ibrahim Pasha of Egypt defeated the Turks in 1832. For the modern town see **KONYA**.

**ICONOCLASTS**, a transliteration of a Greek compound word meaning image breakers. First pictures, then images, of Christ and saints were early introduced into churches as aids to devotion and instruction. The veneration of these images rose to a degree many considered idolatrous. Opposition to the practice and its abuses was strong in the Eastern churches, especially in Asia Minor. The acute phase of the dispute, called the iconoclastic controversy, began with the decree of the Emperor Leo the Isaurian in 725 abolishing the use of icons. The proclamation brought on widespread, often fanatical, destruction of images. Outbreaks continued under Leo's successors and ended with the accession of Theodora in 842. Iconoclasm was one of the issues, though not the chief, that led to the estrangement and finally to the separation of the Eastern Orthodox and the Roman Catholic churches. The second Council of Nicaea, 787, condemned iconoclasm and declared that sacred images were to be venerated for what they represented, not honored in themselves. See **IMAGE**; **BYZANTINE EMPIRE**, *Controversy over Images*.

**ICOSAHEDRON**. See **POLYHEDRON**; **MENSURATION**.

**ICTINUS**, died ?450 B.C., Athenian architect, who flourished during the Age of Pericles. With Calicrates he designed the Parthenon at Athens; it was completed in 438 B.C. (See **PARTHENON**.) Ictinus was also the architect of the beautiful temple of Apollo Epicurius at Bassae (near Phigalia in Arcadia) and of the shrine at Eleusis in which the mysteries were celebrated.

**ID**. See **PSYCHOANALYSIS**, *Psychoanalytic Conception of the Personality*.

**IDA**, a mountain range in Mysia, Asia Minor, scene of the rape of Ganymede and of the judgment of Paris, and (in Homer) the place from which the gods watched the battle between the Trojans and Greeks. It was intimately connected with the worship of Cybele. The modern Turkish name for the range is Kazdağı (5,810 ft.).

**IDA**, also **Idc**, or **Isiloriti**, a mountain (8,195 ft.) in the center of the island of Crete, associated with the worship of Zeus, whose birth was believed to have taken place in a cave there.



# IDAHO

## The Gem State



UNION PACIFIC RAILROAD

Rich in minerals, forested mountains, and such natural wonders as the Snake River

**IDAHO**, state, NW United States; bounded by Canada on the N, Montana and Wyoming on the E, Utah and Nevada on the S, and Oregon and Washington on the W; area 83,557 sq. mi., including 788 sq. mi. of inland water; pop. (1950) 588,637. Idaho's extreme length is 485 miles and its width ranges from 50 to 300 miles. Idaho ranks 13th among the states in area and 43rd in population. *Idaho* is a Shoshoni name meaning gem of the mountains; hence the nickname Gem State. The state motto is "*Esto perpetua*" (Endure forever); the state flower is the syringa. Idaho was the 43rd state to enter the Union. Boise is the capital. See map in Atlas, Vol. 20. For the state flag in color, see FLAG.

**Topography.** The surface of the state is rough and mountainous, diversified by fertile river valleys, upland meadows, rolling prairies, broad plateaus, and arid deserts, with many rugged canyons and deep gulches. The altitude is generally high, the extremes being 738 feet at Lewiston and 12,655 feet for Borah Peak (in the Lost River Mountains). The state lies west of the Rocky Mountain divide, and is cut by a number of mountain ranges, Cabinet, Clearwater, and BITTERROOT MOUNTAINS, to the north; the Salmon River and Sawtooth mountains, in the middle; the Bear, Blackfoot, and Snake River ranges, to the southeast. Extending northeastward from the southwest corner of the state is a lava plateau, which is deeply cut by the SNAKE RIVER. In southeastern Idaho large stretches north of this river, covered with drifting sand, are known as the Snake River Plains. Prominent in the midst of this arid region are the detached peaks, Three Buttes, famous landmarks for travelers for many years. Big Butte is a volcanic cone rising to a height of 7,659 feet above sea level, and nearly 2,500 feet above the plain. West of Big Butte is a vast area of lava flows, part of which has been set aside as Craters of the Moon National Monument. North of the Snake River Plains is the fertile Camas prairie. The southeastern part of the state lies in the Great Salt Lake Basin. The remainder is drained by the Coeur d'Alene, Kootenai, CLARK FORK, Snake or Shoshone, and Spokane rivers. The Snake with its tributaries, the SALMON, BOISE, Payette, and Clearwater rivers, drains 60,000 square miles. This river is notable for its remarkable falls, particularly the American, Shoshone (210 ft.), and Salmon, and for its great canyon. The available water power is very great, and many thousand horsepower have been developed, much of which is used in mining operations.

There are two lake regions: one in the panhandle

includes PEND OREILLE, COEUR D'ALENE, and Kaniksu lakes; the other in the southeast includes John Day and Bear lakes. The overflow of Bear Lake passes into Great Salt Lake through Bear River. These lake regions are among the finest hunting grounds in the United States.

**Climate.** Idaho has a dry middle latitude climate with extreme variations between mountains and valleys. The average annual temperature is 45.6° F.; extremes of 118° and -60° have been recorded. Deep snows during the January wet period amount to 58.1 inches annually, about two-thirds of the annual precipitation. In the northern mountainous section the average annual precipitation is 25.97 inches; in the vicinity of Boise 15.74 inches; and in the southeast near the Great Salt Lake region, 12.73 inches. Prevailing westerlies warm the area; high winds occur during the winter and early spring but are not noticeable in the protected valleys. The growing season varies with the topography, the last killing frost is usually in April and the first in September. Several mountain stations record no frost-free period. Temperatures of about 20° permit the planting of winter grains and alfalfa during January and February. The protected valleys are used for winter resorts where skiing and swimming in outdoor pools heated by thermal springs are the main attractions. See SUN VALLEY.

**Plants and Animals.** Of great commercial importance are several kinds of towering pine, spruce, and cedar which mantle Idaho's mountains with a rich green that lasts through all the seasons. In the open spaces on the lower levels grow mountain laurel and many smaller shrubs which bear both flowers and fruit. Balsam, lupine, and daisies carpet the mountain meadows. The syringa, a tall bush from 6 to 12 feet in height, grows on the mountain sides and along the borders of forests. The Indians used its pliable stems for tobacco pipes, bows, and cradles. Among the state's numerous flowering desert plants are the graceful sego lily, the purple frutillaria, the stonecrop, a desert grass; the old maid's hair, the owl clover, and the balsamroot, which the Indians use as food. Sagebrush is common, especially on the Snake River Plain.

Among the wild animals found are the grizzly bear, black bear, raccoon, panther, badger, wolf, fox, coyote, lynx, mink. The bison, once common, is no longer seen, but moose and elk are found and deer and antelope are numerous. The Rocky Mountain sheep is found in the Coeur d'Alene Mountains.



Potatoes are Idaho's second most valuable crop

UNION PACIFIC RAILROAD

## PEOPLE

**Population.** According to the Federal census for 1950 the population of Idaho was 588,637, an increase of 63,764, or 12.1 per cent, over 1940 (compared with an increase of 17.9 per cent during 1930-40). The urban population of the state was about 43 per cent of the total.

### PRINCIPAL CITIES

#### POPULATION

|                      | Census 1940 | Census 1950 |
|----------------------|-------------|-------------|
| BOISE (Capital)..... | 26,130      | 34,393      |
| POCATELLO.....       | 18,133      | 26,131      |
| IDAHO FALLS.....     | 15,024      | 19,218      |
| TWIN FALLS.....      | 11,851      | 17,600      |
| NAMPA.....           | 12,149      | 16,185      |
| LEWISTON.....        | 10,548      | 12,985      |
| COEUR D'ALENE.....   | 10,049      | 12,198      |
| MOSCOW.....          | 6,014       | 10,593      |
| CALDWELL.....        | 7,272       | 10,487      |
| BURLEY.....          | 5,329       | 5,924       |

**Education and Public Welfare.** The educational interests of the state are in charge of a board of education, of which the superintendent of public instruction is a member. The colleges are the University of Idaho at Moscow, Idaho State College at Pocatello, Northern Idaho College of Education at Lewiston, Southern Idaho College of Education at Albion, College of Idaho (Presbyterian) at Caldwell, Northwest Nazarene College at Nampa, and Farragut College and Technical Institute.

The State Department of Public Welfare manages the state hospitals for the insane at Blackfoot and Orofino, the school for the feeble-minded at Nampa, the state industrial school at Saint Anthony, the soldiers' home at Boise, and the hot springs at Lava. The state penitentiary at Boise is under separate direction. Several of these institutions maintain farmlands which are worked by the inmates.

## ECONOMIC LIFE

**Minerals and Mining.** Idaho is rich in mineral resources, and mining has been one of the principal industries of the state. The discovery of great gold deposits in the Coeur d'Alene district about 1860 was, in fact, chiefly responsible for the first settlement of this region. Gold has continued in importance, but even more valuable is the production of silver, lead, and zinc. Idaho has ranked first among the states in the annual production of silver, second in the output of lead, and near the top in the production of zinc. The Coeur d'Alene district accounts for nearly all the lead and for most of the silver and zinc produced in the state. There are small areas of fine crystalline marble and large quantities of opal, including a choice grade of fire opal. Mineral springs are numerous. In 1952, when its mineral production was valued at \$77,060,000, Idaho ranked 28th among the states. Idaho is accredited with more than 85 per

cent of the total phosphate resources of the United States, some 268,000 acres, which have been withdrawn from public entry. It has been estimated that nearly five billion tons are available, the greatest potential mineral resource of Idaho. Some of the largest deposits of high-grade barites found west of the Mississippi occur in Blaine County.

### MINERAL PRODUCTION OF IDAHO

| MINERAL           | UNIT<br>(Thousands) | 1949   | 1951   | 1952   |
|-------------------|---------------------|--------|--------|--------|
| Antimony.....     | Short tons          | 4      | 8      | 4      |
| Copper.....       | Short tons          | 1      | 2      | 3      |
| Gold.....         | Troy ounces         | 77     | 45     | 32     |
| Lead.....         | Short tons          | 79     | 76     | 73     |
| Pumice.....       | Short tons          | 71     | 83     | 88     |
| Sand and gravel.. | Short tons          | 3,271  | 4,057  | 3,925  |
| Silver.....       | Troy ounces         | 10,049 | 14,753 | 14,923 |
| Zinc.....         | Short tons          | 76     | 78     | 74     |

**Agriculture and Stock Raising.** The soil in the river basins, in the northern, western, and south-eastern parts, is a rich alluvial deposit, remarkably productive under irrigation. That of the uplands is mostly clay and sand, and is suitable for grazing. The larger part of the agricultural land is the plateau along the Snake River. Excellent crops are produced with the aid of the extensive irrigation projects, most of them in the Snake River Valley. (See IRRIGATION.) Dry farming is practiced in the higher districts in the southern part of the state. The total area of farms in Idaho is more than 10,000,000 acres. Livestock constitutes a substantial part of the state's agricultural wealth. Large cattle ranches are common, a few covering several thousand acres. The raising of sheep is highly important, and the production of wool is of high economic value.

### PRINCIPAL CROPS OF IDAHO

| CROP            | UNIT<br>(Thousands) | 1944-53<br>Average | 1954   | 1955   |
|-----------------|---------------------|--------------------|--------|--------|
| Apples.....     | Bushels             | 1,655              | 1,130  | 1,670  |
| Barley.....     | Bushels             | 11,600             | 18,005 | 18,432 |
| Beans.....      | Bags                | 2,396              | 2,870  | 2,691  |
| Corn.....       | Bushels             | 1,654              | 3,233  | 3,690  |
| Hay.....        | Tons                | 2,411              | 2,763  | 2,890  |
| Hops.....       | Pounds              | 1,478              | 3,312  | 3,360  |
| Oats.....       | Bushels             | 7,839              | 10,560 | 10,032 |
| Potatoes.....   | Bushels             | 41,758             | 40,800 | 51,550 |
| Sugar Beets.... | Tons                | 1,201              | 1,569  | 1,465  |
| Wheat.....      | Bushels             | 37,657             | 36,198 | 37,388 |

**Forestry.** The vast forests of Idaho are one of the greatest sources of wealth to the state. The national forest reserves cover about 20,000,000 acres or 90 per cent of the acreage of the state. It is estimated that the amount of standing timber in national forests is about 47 billion saw board feet and 6 million cords of wood. The growth is mainly coniferous: white

### Lumbering operations in a ponderosa pine forest

U.S. FOREST SERVICE

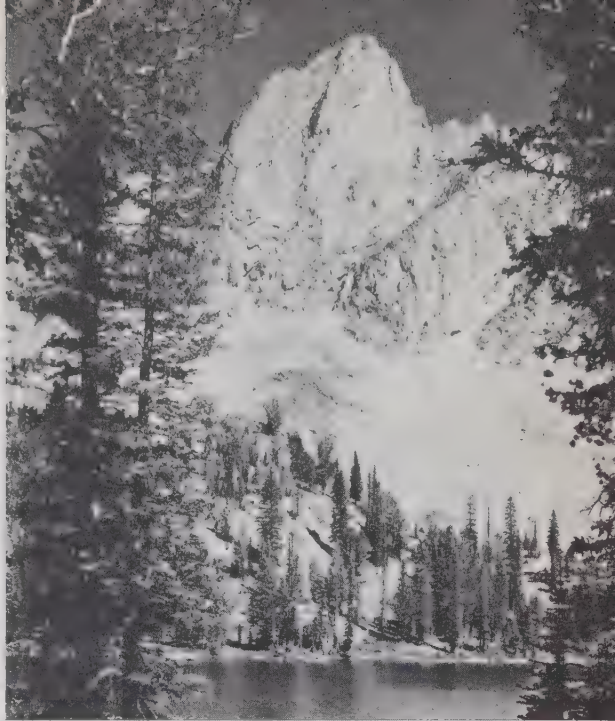






IDAHO STATE C. OF C.

**Pastoral scene on an Idaho sheep ranch**



IDAHO STATE C. OF C.

**Alice Lake and Half Dome of Sawtooth Mountains**

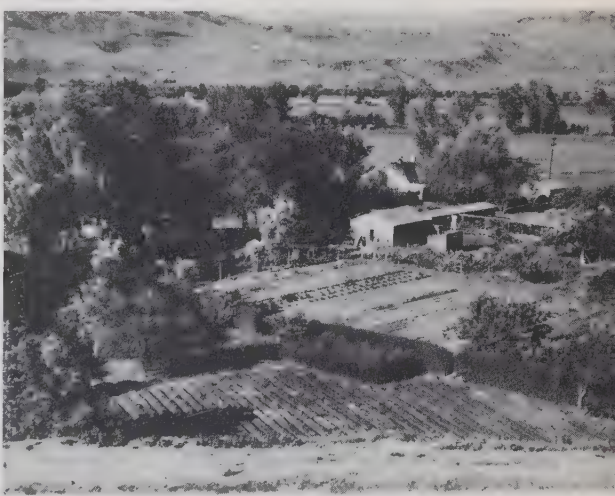


FRANZ LIPP

**Craters of the Moon National Monument**

**Cattle grazing in Boise National Park**

U.S. FOREST SERVICE

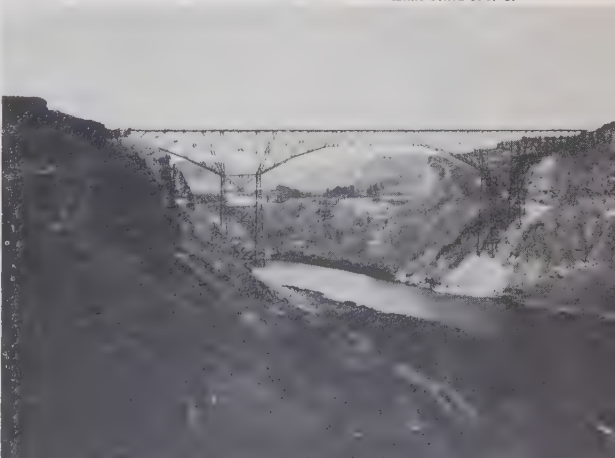


U.S.D.A.

**A fertile irrigated valley in Ada County**

**Twin Falls-Jerome Bridge across the Snake River**

IDAHO STATE C. OF C.



pine, yellow pine, red and white fir, and cedar. Much of the area contains young timber which is not yet ready for cutting.

**Manufactures.** In recent years there has been a considerable increase in manufactures in Idaho. A favoring factor has been the presence of abundant water power. The leading industry, as may be expected in view of the enormous forest resources, is lumbering. The state has some of the largest lumber mills in the world, notably at Lewiston and Potlatch. Valuable also are beet sugar, butter, flour and other grain-mill products, slaughtering and meat packing, railroad shop construction and repairs, printing and publishing (newspapers and periodicals), wood preserving, and cheese. Canning and preserving, and the manufacture of clay products, confectionery, gas, and ice also are important. Much of the manufacturing is done in small towns and there is no concentration of plants in the cities. Although manufacturing is growing, the state still exports much of its raw materials such as wool, livestock, and phosphate rock.

**Transportation.** Idaho has about 3,000 miles of railroads. The Great Northern and Northern Pacific cross the northern part of the state, and the Oregon Short Line crosses the southern part, the three lines reaching 73.3 per cent of the communities. The central part of Idaho depends upon highways and the bus lines which give daily service. The state maintains 4,800 miles of roads of which 3,245 miles have been surfaced. Idaho's first highway, the old OREGON TRAIL, stretched across 400 miles of the southern part of the state; the section is now a magnificent highway. The Celilo canal on the Oregon side of the Columbia River connects Idaho with the Pacific; vessels from Lewiston traverse the 480-mile route through the Snake and Columbia rivers. The state is served by several air lines; Salt Lake City, in Utah, is the hub of the air traffic.

**Tourist Attractions.** Idaho is a state of rugged beauty where, years after its settlement, there are remote areas in its high mountains which never have been explored. A land of extremes, its desert-like plains and fertile valleys contrast with vast forest-mantled mountain areas. Concealed in the mountain fastness are thousands of unnamed gorges, unnumbered caves, countless hot and cold mineral springs, and uncharted lakes and waterfalls. Many mountain wonders can be glimpsed from highways or railroads, but large areas are impenetrable except by pack horse. An outstanding sight is the Hell's Canyon of the Snake River, rival of the Grand Canyon of the Colorado in depth. Attractions in season are trout fishing, big game hunting, mountain climbing, and winter sports in the famous Sun Valley. In the southeast corner of the state is the western entrance to YELLOWSTONE NATIONAL PARK, of which a small acreage lies within Idaho. In southern Idaho, CRATERS OF THE MOON NATIONAL MONUMENT preserves a great area of unique volcanic phenomena, including fissure eruptions, cones, craters, caves, and lava flows. Heyburn and Lawyers Canyon state parks offer fine recreation areas in the mountains, and Spalding Memorial Park preserves the first mission in Idaho, started in 1836.

Idaho's 1,800 Indians of the Shoshone and Bannack tribes hold annual ceremonials at Fort Hall Reservation, and the Nez Percé Indians on Lapwai Reservation hold tribal powwows. The old West is also revived in colorful roundups and rodeos in many Idaho communities. Scattered over the state are interesting ghost towns, survivals of the early mining boom in Idaho.

F. C. W.

**Government.** The present constitution was drafted in 1889, just prior to the state's admission to the Union in 1890; by 1945 a total of 47 amendments had been added. Constitutional amendments are proposed by a two-thirds vote of the members of each house, and referendum. For voting a residence of six months in the state and 30 days in the county is required. The

state has the open primary. The state legislature consists of a senate of 44 members and a house of representatives of 49, all members being elected for two-year terms. A regular session of the legislature is held biennially in the odd years beginning in January; compensation is \$5 a day for 60 days. The governor has a veto on legislation (including the item veto on appropriation bills), but the legislature may override such veto by a two-thirds vote of the members in each house. The elected state officials include the governor, lieutenant-governor, secretary of state, attorney general, treasurer, and auditor chosen biennially. Other administrative officers are appointed by the governor with the consent of the senate. State officials may be removed by impeachment, charges being voted by the house and tried before the senate. The state supreme court consists of five justices elected by the state at large for six-year terms. There are 11 district courts with 16 judges, all elected for four-year terms; at least two terms of district court must be held in each county every year. Each county has a probate court with jurisdiction over probate matters and also with minor civil and criminal jurisdiction. Finally, there are justices of the peace with criminal jurisdiction in minor cases. In the Congress at Washington the state has two senators and two representatives.

#### HISTORY

**The Early History** of Idaho is bound up with that of the states of OREGON and WASHINGTON. In 1859 gold was discovered in the Pierce City region and by the autumn of 1862 there were 30,000 persons near Lewiston. The greater discovery in the Boise basin followed, and within a year Idaho City had 40,000 inhabitants. Idaho formed part of Washington Territory until Mar. 3, 1863, when it became the Territory of Idaho, with Lewiston as its capital. It included Montana (separated in 1864) and Wyoming (separated in 1868). These changes reduced the limits of Idaho to those described in the act of admission to statehood, approved July 3, 1890. The west boundary of Idaho from the mouth of the Clearwater to the 49th parallel was surveyed and marked in 1873 under the direction of the General Land Office. The surveyor who did this work spent several days in attempts to find the position of the mouth of the Clearwater and finally selected the point where empty casks set adrift in the channels of the Snake and the Clearwater bumped together. This line was retraced and 177 stone or iron posts were set on it by the U.S. Geological Survey in 1908. When the western boundary of Wyoming was surveyed in 1874, it was found that the intersection with the south boundary of Idaho (as marked in 1871) was not in accord with the initial point previously fixed for the Utah-Idaho boundary survey.

At the census of 1870 only 15,000 remained of the swarm of miners of the early sixties; but \$200,000,000 worth of gold had been taken out of Idaho—the greatest record in history for the same period of time.

Serious conflicts with Indians, in which many settlers and soldiers were killed, occurred in 1877-79. In 1880 agriculture received new impetus from the introduction of irrigation. The Oregon Short Line Railroad opened up the SNAKE RIVER valley; and, with the discovery of silver-bearing lead in the Coeur d'Alene district, immigration increased. In 1889 Idaho adopted a new constitution, and in 1890 was admitted to the Union. See NEZ PERCÉ INDIANS.

**20th Century.** In 1905 Governor Steunenberg was assassinated following his efforts to subdue rioting miners with the aid of Federal troops. The trial of WILLIAM D. HAYWOOD, secretary of the Miners' Federation, resulted in his acquittal but Harry Orchard, who pleaded guilty in 1908 was condemned to life imprisonment.

In 1923 the American Falls project was authorized, to bring 110,000 acres of land under irrigation and stabilize the water supply for 560,000 acres of irri-



# IDAHO

## High Lights of History



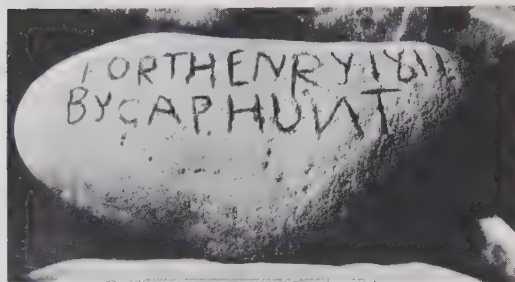
COEUR D'ALENE PRESS

Sacred Heart, or "Old" Mission near Cataldo was begun in 1848 and first used for services in 1852



AMERICAN PIONEER TRAILS ASSN.

Emigrants at Fort Hall in 1834



IDAHO STATE COLLEGE

Astorian Land Expedition led by W. P. Hunt left this rock "calling card" at Old Fort Henry in 1811



SMITHSONIAN INST.

Chief Joseph of the Nez Perces, left; "Attacked by Nez Perce Indians," right



Boise Street Scene, 1866. Boise, founded in 1863, became the capital of Idaho Territory and was incorporated as a city of the second class in 1864

ANSGAR JOHNSON

gated land, at a cost of \$8,500,000. In 1924 the North and South Highway was completed, breaking through what was formerly an almost unsurmountable mountain barrier. In 1924 the Black Canyon Dam near Emmett was completed and in 1925 the main line of the Union Pacific to Boise. In World War I Idaho had 24,819 men in the American armed forces. Some 61,200 Idaho men and women served in World War II, with death casualties numbering about 1,800. Idaho in 1950 voted to grant full citizenship rights to the Indians residing in the state. In 1951 the Atomic Energy Commission's experimental "breeder" reactor, the first in the world, went into operation at Arco, in southeastern Idaho. F. M.

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**IDAHO, COLLEGE OF.** See COLLEGES.

**IDAHO FALLS,** city, E Idaho, county seat of Bonneville County, on the Snake River, the Union Pacific Railroad, U.S. highways 91 and 191, and the Western Air Lines; about 50 miles NE of Pocatello. Idaho Falls is the third largest city in Idaho and a metropolis of a vast, rich agricultural district. It is beautifully situated in a vacation land at an altitude of 4,708 feet. Gushing over jagged rocks just two blocks from the business district of Idaho Falls is the turbulent Snake River Falls from which the city derives its name. Manufacture consists of processing agricultural products grown in the Snake River Valley, including: potatoes, sugar beets, seed peas, small grains, cattle, sheep, hogs, turkeys, and other poultry. Pop. (1950) 19,218.

**IDAHO SPRINGS,** city, N Colorado, in Clear Creek County, on Clear Creek and U.S. highways 6 and 40, about 32 miles W of Denver. Idaho Springs is a mining center and resort with popular mineral springs. It was settled in 1861 by George Jackson who had discovered gold here two years earlier. Near by is the Edgar Mine maintained by the Colorado School of Mines for practical undergraduate work and graduate research. Pop. (1950) 1,769.

**IDAHO, UNIVERSITY OF.** Founded in 1889, the University of Idaho at Moscow began instruction three years later. The colleges of Letters and Science and Agriculture were established in 1900, followed by Engineering, 1907, and Law, 1909. Schools of Mines and Forestry were added in 1917; Education in 1920, Business Administration and a Graduate School in 1925. A campus at Pocatello houses a junior college and a four-year School of Pharmacy.

ROBERT MARSH

**IDALIUM,** ancient town, Cyprus. Adjoining it was a temple sacred to Aphrodite, from which the goddess was sometimes called Idalia. Ancient cemeteries, ruins of temple, coins and statues have been found in or near the town. In 1868 a bilingual inscription (Phoenician and Cypriote) was discovered, from which the ancient language of Cyprus was first ascertained to be a dialect of Greek.

**IDAR,** or **Edar,** former state, India, now part of Bombay; area 1,905 sq. mi.; pop. (1941) 307,798. The chief products are grain, sugar cane, and oil seeds. The state was created in the 18th century by a branch of the Rathor clan of Rajputs to which Jodhpur and Bikaner belong. It was often attacked by the Mahrattas and still pays tribute to the ruler of Baroda. The famous Sir Pertab Singh abdicated in 1901 to assume the regency of Jodhpur. He was succeeded by the Maharaja Sir Daulat Singhji, his adopted son. The former capital was the town of Idar; the present capital is Amadnagar.

**IDEAL GAS LAW,** expresses the relationship between pressure, volume, and temperature of an ideal gas:  $\frac{PV}{m} = 0.082 = \text{"the ideal gas constant"}$   
MT

In the above form of the law, P is pressure in atmospheres, V is volume in liters, m is molecular weight, M is mass in grams, and T is ABSOLUTE TEMPERATURE. The law states that this equation holds for any amount of any gas under any conditions.

This law is a combination of BOYLE'S LAW and CHARLES' LAW, formulated in the 18th century, and AVOGADRO'S LAW, formulated in the 19th century. A gas would obey these laws exactly if it were composed of absolutely elastic molecules of negligible volume. Such a gas would be an ideal gas. However, all gases show considerable molecular cohesion, especially at low temperature—that is, as they approach the solid or liquid states—which produces deviations from the ideal law. Furthermore, the volume of the molecules is not negligible, especially at high pressure. Equations have been formulated to correct for such deviations, notably those of van der Waals and Berthelot. See CHEMISTRY, *Laws of Gases*.

**IDEALISM** is a term of very wide, varied, and loose application. Popularly it is opposed to materialism in philosophy, and to realism in art and literature, and then signifies a regard for and insistence upon a higher and more spiritual view of the world and of life, in opposition to those who see only the more material side of reality and the baser side of life—those who in science admit only physical existences and causes, and who in art and literature lay great stress upon the lower and coarser elements in human nature.

Even in philosophy the term is used in a vague and fluctuating fashion; but the main usages are two—a metaphysical and a psychological (or epistemological), corresponding to what may be called the Platonic and the psychological usages of the term idea. In its metaphysical usage idealism is the term applied to philosophies like those of PLATO and Hegel, which maintain the world to be in its most ultimate nature intelligible or spiritual. In its psychological or epistemological usage the term is applied to a doctrine like that of BERKELEY, which regards the external world as existing only for and in the consciousness of individual percipients; while the opposing doctrine of realism asserts the independence of the external world as regards the percipient subject. This latter kind of idealism is sometimes termed *subjective*, and contrasted with the former, which is called *absolute* idealism. See ETHICS; HEGEL; KANT; MATERIALISM; REALISM.

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**IDEAS, ASSOCIATION OF.** See ASSOCIATIONISM.

**IDENTIFICATION,** in psychology means thinking, feeling and acting like someone else on the basis of an absorbed mental picture of the other person's manner of thinking, feeling and acting or of his whole being. This is a largely unconscious process so that the individual is unaware that he is identifying. *Psychoanalysis* distinguishes between primary and secondary identification. In primary identification, which is characteristically seen in children, the child models himself on his parents, imitating mannerisms and attitudes. The subordinate who tries to act like the boss is also doing this. The attempt to identify is related to a real person in the environment.

In secondary identification the object of identification has become a part of the individual. For example, in grief reactions to death the relationship is not to the object which is gone but to the mental image or memory of the departed within the mourner. This is clearly seen in such not uncommon reactions as developing the exact symptoms, e.g., local pains, of which the mourned person complained before his decease.

The emotional response to plays and movies occurs because one feels as if one were the hero on the screen, and he thus becomes temporarily a part of oneself. Other examples of identification are revealed



in everyday expressions such as "You're always in my heart" or "It became part of me." J. KEPECS  
BIBLIOG.—O. Fenichel, *Psychoanalytic Theory of Neurosis* (1945).

**IDES.** See CALENDs.

**IDFU.** See EDFU.

**IDIOCY**, complete, or almost complete absence of intelligence. Idiocy is the greatest degree of mental defect, and refers to conditions where the mental development as an adult is less than that of the average child of three. Idiots cannot learn to talk or to take care of even their simplest needs. Their I.Q. is 20 or below. See MENTAL DEFICIENCY.

M. A. SAFFIR  
BIBLIOG.—M. Sherman, *Intelligence and Its Deviations* (1945).

**IDIOSYNCRASY.** See ALLERGY.

**IDOLATRY**, the worship of idols or other objects believed to possess life and power, or to represent supernatural beings, is widespread among primitive peoples of the world. It also entered into the practices and beliefs of more advanced peoples, such as the Egyptians, Greeks, and Romans.

It is impossible to give a definition which covers all forms of idol worship, but it can be asserted that such practices are not universal neither are they necessary steps in the development of religious ideas. It must be realized also that some peoples had images which they used in ceremonies but which they did not venerate. Missionaries and travelers in strange lands often reported idols where none truly existed. An example of this is found in the island of Nias, off the west coast of Sumatra, where large ancestral figures are exhibited. They are prized, but in much the same way that a civilized man prizes the portrait or bust of an ancestor. Of a different category are certain small wooden figures which stand on a shelf in the chief's house. During certain ceremonies the spirits of the ancestors enter and animate these mannikins. At that moment they are alive, but once the ceremony is over they are not held in veneration.

Among the Toba Batak of Sumatra figures of men and women are used in magical rites, but they are not considered as being animate. These same people do have figures in which portions of the brains of slaves or captives have been placed. These figures do possess life and power and can be commanded, yet they are not worshiped. They may be fed and feted if they bring desired results or they may be punished if they fail.

In some societies images represent powerful beings and the homage paid them is accepted by the god. It also appears that some figures are worshiped be-

cause of a belief that they possess power in themselves.

The line between magic and religion is so thin in the less advanced cultures that any attempt to separate them is often futile—a fact which makes it difficult to differentiate between a mere image and a figure which is actually worshiped.

Idolatry was an essential element of the cults of Egypt, Greece, and Rome, and was widely disseminated in the primitive Semitic world, instances of it being found in the teraphim of Jacob and David (Gen. 31:19, 34; I Sam. 19:13). A more persistent vestige of idolatry among the Israelites was their tendency to relapse from monotheism to a lower stage, exemplified in the making of a golden calf by Jeroboam (I Kings 12:28), the setting up of Ashtoreth (I Kings 14:15, 23), and the readiness to embrace such foreign deities as Ashtoreth and Baal (I Kings 11:5; 16:32). The unseen Jehovah was too high and illusive conception for the common man among the Hebrews; and till after the Captivity there was a constant tendency to substitute for Jehovah less worthy ideas of the Godhead, but also to fashion some visible and tangible representation either of the lower deities or of Jehovah Himself.

The graven image and the picture have had their part in the development of the church worship of medieval and modern Christianity, chiefly as aids to religious contemplation and devotion. The Reformed churches do not permit their use, but the Lutheran churches still admit of images by way of ornament or as helpful to devotion. See FETISHISM; ICONOCLASTS.

**IDOMENEUS**, king of Crete, son of Deucalion, was the captain of the Cretans in the TROJAN WAR. Post-Homeric traditions tell that in a storm he vowed to sacrifice to Poseidon whatever he should first meet on landing. This was his son, whom he accordingly sacrificed. But as a plague visited the island in consequence, he was expelled, and settled first in Calabria in Italy, and afterward near Colophon. His tomb, however, was shown at Cnossus in Crete.

**IDRIA**, Slovene Idrija, mining town, NW Yugoslavia, situated in the narrow valley of the Idria River in the Julian Alps; 75 miles SW of Ljubljana (Laibach). It is noted for its quicksilver mines which were discovered in 1490 and provide almost half the world's supply. Idria has an interesting 16th century castle. Industries include shipbuilding, fisheries, and manufactures of lace and linen goods. Exports are products of the two chief manufactures and olives, olive oil, and fine wines. Once a part of the Austrian province of Carniola, Idria was awarded by the Treaty of Rapallo in 1920 to Italy. In 1947, after World War II, it was ceded to Yugoslavia by the treaty of peace between the United Nations and Italy. Pop. about 5,000.

**IDUMAEA**, the Greek form of Edom found in the Bible. Although the Biblical Edom extended from the Dead Sea to the eastern head of the Red Sea, Idumaea in later Jewish and Roman history signifies the northern part of Arabia Petraea and the southern part of Judaea as far as Hebron. See EDM.

**IDUN**, in Norse mythology, the goddess personifying the reviving year, keeper of the golden apples which the gods tasted to renew their youth. She was carried off by Thiassi (winter) and imprisoned in the nether world, from which she escaped again in spring in the form of a bird.

**IDYL**, or **IDYLL**, a highly wrought narrative poem, generally descriptive of pastoral scenes, such as the idylls of Theocritus, Bion, and Moschus. In his *Idylls of the King*, TENNYSON uses the word in its original meaning of "pictures," "select representative tableaux," as distinguished from the formal epic.

**IE ISLAND**, one of the Ryukyu Islands, three miles off the Motobu Peninsula, extending from the W side of OKINAWA ISLAND. The island, five miles long and two miles wide at its widest point, is fertile and has a thick growth of trees. At the east end

Bronze dancing idol of Hindu god Siva

WILLIAM R. NELSON ART GALLERY



Mount Iegusugu, a volcanic peak, rises 558 feet. During World War II American forces invaded Ie in April, 1945, capturing it after severe fighting in which the famed war correspondent, ERNIE PYLE, was killed. It was on the Ie airfield that the first Japanese surrender emissaries changed from their Japanese planes to an American plane, Aug. 19, 1945, on their way to General MacArthur's headquarters in Manila.

**IESI**, ancient **Aesis**, medieval walled town and episcopal see, E central Italy, in the department of the Marches; situated near the left bank of the river Esino, about 20 miles by rail SW of Ancona. Features of interest include the Palazzo del Comune, a 14th century church, and a 15th century castle. Industries include the manufacture of matches, silk and woolen goods, wine, and paper. Emperor Frederick II (Barbarossa) was born here. Pop. (1949 est.) 19,500.

**IEYASU**, or **IEYASU**, **TOKUGAWA IEYASU**, 1542–1616, one of the greatest of Japanese statesmen and founder of the Tokugawa dynasty of shoguns of Japan who, at Edo (Yedo, now Tokyo), governed the empire in the name of the emperor from 1603 to 1867. He was born at Okazaki, in the province of Mikawa, in the minor daimyo (feudal baron) family of Tokugawa. The name derived from the village of Tokugawa, Kozuke Province, where the family lived prior to moving to Mikawa. Descended from the ancient Minamoto house of imperial origin, the Tokugawas became one of the most powerful families in Japanese history. Several Tokugawa peers ranked high in pre-World War II nobility. The Tokugawa crest is of three hollyhock leaves, best known next to the imperial chrysanthemum crest. A code of laws enacted by Ieyasu was a kind of constitution, under which Japan was governed until the Meiji restoration. He had nine sons, the third, Hidetada, becoming second in the line of 15 shoguns. See **JAPAN, History**.

**IF**, rocky islet in the Gulf of Lyons, France, two miles SE of Marseille. The fortress Château d'If was built by Francis I in 1529, and was later used as a state prison—Mirabeau and Philippe Egalité being among its more illustrious occupants. Dumas, in his *Count of Monte Cristo*, imprisons his hero in the château.

**IFFLAND**, **AUGUST WILHELM**, 1759–1814, German actor and playwright, was born in Hanover. After winning a great reputation at Mannheim, he in 1796 became director of the National Theatre in Berlin, and in 1811 general director of the royal Prussian theaters. He was very successful as actor, manager, and playwright, some of his plays being minor classics. *The Lawyers*, *The Bachelors*, *The Foresters*, *The Nephews* (all in 1799), *Crime from Ambition* (1800), and *Conscience* (1801) are among the best.

**IFNI**, Spanish colony on the coast of SW French Morocco, some 60 miles NE of Rio de Oro; area 741 sq. mi.; population 43,000. It has belonged to Spain since 1860 and has been occupied by that country since 1934. With Spanish Sahara, it is under a politico-military government, and is directed by a sub-governor responsible to the high commissioner of Spanish Morocco.

**IGARKA**, town and port, U.S.S.R., the Russian Soviet Federated Socialist Republic, in Krasnoyarsk Territory, situated on the lower Yenisei River, within the Arctic Circle. The growth of the lumber industry near the Yenisei makes it economical to float timber to the port of Igarka for distances as great as 1,000 miles. Igarka was established as the principal port for the Northern Sea Route because of its excellent harbor and the current of the river here, which is not too fast for the control of the logs. During 1937 some 90 million board feet of lumber were exported through the port of Igarka. Sawmills work throughout the winter and the timber is stacked ready for shipment in the summer. Navigation opens in August; all the lumber has to be out of the Arctic waters by the end of September at the latest. The value of Igarka as the center of export lies in the fact that a journey by river and rail to European Russia is twice

as expensive. Airplane connections with the rest of Krasnoyarsk Territory are maintained the year around.

Although the subsoil of Igarka is perpetually frozen, a state farm of several hundred acres outside the town produces its grains and vegetables by using a special seed which is vernalized before being sown. To supply meat and milk for the town several hundred cattle and pigs are maintained; they are kept in specially heated sheds through the long months of Arctic winter.

By 1939 the population of Igarka was about 20,000—a remarkable figure for a town situated in the Arctic Circle. During the summer the population is increased by the addition of some 3,000 seasonal workers. In 1950 the population of the town was estimated to be 40,000. A. M. K.

**IGLAU**. See **JIHlava**.

**IGLESIAS**, town and episcopal see, Italy, Sardinia, in Cagliari Province, 34 miles NW of Cagliari. It is situated on the island's west coast, in a region of lead and zinc mines. A school of mines is built high in the mountains to the southwest of the town. The Spanish Gothic cathedral in Iglesias dates from 1285, and the citadel (1325) has been remodeled into a glass factory. The town is still partly surrounded by ancient walls. It was heavily bombed during World War II just before Sardinia was taken by Free French troops in August, 1943. Pop. 26,976.

**IGNATIUS OF ANTIOCH, SAINT**, fl. A.D. 90, bishop of Antioch and one of the "Apostolic Fathers." Little is known about his life. According to a tradition, he was a pupil of John, the Apostle, and Origen recorded that Ignatius was the second bishop of Antioch after Peter. During the reign of TRAJAN (A.D. 98–117), persecution of the Christians broke out in Antioch and Ignatius was seized and sent to Rome where he suffered martyrdom (c. 115).

On his way to Rome Ignatius was met at Smyrna, Troas, and other points on the journey, by fellow Christians, and also received letters from a number of the Christian churches. In response to these communications, Ignatius wrote a series of epistles which have long been the subject of much controversy. From early times a group of 15 so-called Ignatian Epistles have been known, but in the course of time scholars rejected three of the letters as spurious, classed five of them as of doubtful authenticity, and accepted seven of them as probably genuine. The seven letters which are generally regarded as authentic are those written to the Ephesians, Magnesians, Romans, Trallians, Philadelphians, Smyrniotes, and Polycarp. Polycarp is considered the most completely genuine of all the Ignatian writings. The letter to the Romans is largely personal in character, while the other six letters are chiefly concerned with matters of doctrine. These letters uphold the doctrine of the divinely instituted Church, maintaining the primacy of the see at Rome, the dogmatic nature of Apostolic Christianity, and the infallibility, holiness, catholicity, and unity of the one true Church.

The genuine letters of Ignatius have great value, not only because of the doctrinal material which they contain, but also because they include considerable information about the early state of the church and of Christianity immediately following the apostles. Although few facts are available concerning Ignatius, his writings reveal something of his character, showing him to be a man of great integrity, understanding, and sympathy, as well as a tireless worker for the cause of Christianity. See **POLYCARP**.

W. G. D.

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**IGNATIUS OF CONSTANTINOPLE, SAINT**, 799?–878, a patriarch of Constantinople, his birthplace. The son of Emperor Michael I, he was given the name Nicetas. He was castrated and imprisoned



in a monastery (813) by Leo V, where he embraced the religious life and assumed the name Ignatius. He was made patriarch of Constantinople about 846, but was deposed about 858 because of his excommunication of Bardas, who was regent for, and uncle of, Michael III. Photius was appointed to replace Ignatius, who was exiled but appealed his case to Pope Nicholas I, who upheld the validity of his claim. He did not regain possession of his see, however, until Michael III was assassinated and Basil I became emperor (867). The Fourth Council of Constantinople excommunicated Photius and validated the right of Ignatius to the see of Constantinople. The rivalry between Ignatius and Photius was the immediate cause of the schism which resulted in the separation of the western and eastern churches. The feast day of St. Ignatius is October 23.

**IGNATIUS OF LOYOLA, SAINT**, born **Inigo Lopez de Recalde**, c. 1491–1556, Spanish mystic and founder of the Society of Jesus, or **Jesuits**. The youngest of 13 children, Ignatius was born in the Castle of Loyola close to Azpeitia, in the Spanish province of Cuipúzcoa near the frontier of France. He became a page in the court of Ferdinand the Catholic (1452–1516) at the age of 14, but grew to dislike court life and entered the army in 1517, achieving the rank of captain. He was wounded in 1521, and, while waiting for a broken leg to heal, he read the *Life of Christ* by Ludolphus and some biographies of saints. These so inspired him that he went to the shrine of the Virgin at Montserrat in 1522, renounced his military career, and dedicated his life to spiritual endeavor. Following his experience, he lived for 10 months in a cave near Manresa, practicing rigorous austerities and writing the first version of his *Spiritual Exercises*, a work which in various later revised forms exerted great influence upon his followers. After an unsuccessful pilgrimage to the Holy Land in 1523, Ignatius realized that he must have more knowledge in order to accomplish his objectives. To secure an education he studied Latin with young boys in a public school at Barcelona (1524–26), and attended universities at Alcalá (1526–27), Salamanca (1527–28), and finally Paris (1528–35).

**Founding of the Jesuits.** While a student in Paris, Ignatius and six companions including **FRANCIS XAVIER** (1506–52), banded together into a religious confraternity out of which the Jesuits later developed. In 1534 Ignatius and his companions took the vows of chastity and poverty in the Church of the Martyrs on Montmartre, and resolved that they would go to Palestine. The war between the Christians and the Turks prevented the group from carrying out their plan to evangelize the Holy Land, but they were ordained (1537). They were received by Pope Paul III in 1537 and pulpits in various churches were assigned to them. The group attracted many followers; and, in 1539 Ignatius asked for, and with difficulty received, papal approval (1540) of the formula which he had drawn up for a new order, the Society of Jesus. This formula, which was later revised a number of times, became the *Constitutions* of the Jesuits and Ignatius was elected (1541) general of the order, which he continued to lead, despite his efforts to resign, until his death. The remaining years of his life were spent in Rome which became the headquarters of the new order.

**Social Reforms.** Despite the fact that much of his time was taken up with directing the Jesuits and in revising the *Constitutions*, Ignatius was able to devote a great deal of his energy to the accomplishment of social reforms. Although he was greatly interested in Jewish converts to Christianity, he also proved himself to be the friend of orthodox Jews by bringing about the correction of many abuses in the treatment which they received. He was the founder of homes for friendless women and girls and also established orphanages for boys and girls. Through the power



"Miracle of St. Ignatius de Loyola," by Rubens

of his influence, he was able to bring about an end to the quarrel which had existed between John III, king of Portugal, and the pope. Another dispute, between Margaret of Austria and the people of Tivoli, was likewise settled by his diplomatic intervention.

**Personal Sanctity and Growth of the Society.** Although a religious mystic, Ignatius was also a man of practical action and executive ability. As leader of the Society of Jesus, he devoted much of his time to perfecting details of the order's organization and also kept in touch with the work of the Jesuits in different parts of the world. At the time of Ignatius' death, the order numbered approximately 1,000 members and 101 houses located in Brazil, Germany, India, Italy, Japan, Portugal, and Spain. Two major concerns dominated a great deal of his thought and action: his desire to spread Christianity by means of foreign missions and his interest in the education of boys. Much of the activity of the order which he had founded was directed toward carrying out these two great objectives.

It has sometimes been said that the beginning of the Reformation exerted a great influence upon Ignatius, and that the dominant motive which inspired him to establish his order was his desire to combat the spread of reform. Ignatius, however, did not express great concern over the religious movements taking place in Europe, especially Germany, and it would appear that the Reformation had little if anything to do with the organization of the Jesuits or any of the other activities of Ignatius. Above all else, the supreme aim of Ignatius was the imitation of Christ, and it was this goal which dominated all of his relationships with others and his writings.

**Writings.** The literary works of Ignatius include the *Spiritual Exercises*, the *Constitutions*, a partial autobiography, *The Testament of Ignatius Loyola* (1900),

and letters. The *Spiritual Exercises* not only formed the basis of the spiritual training of the Jesuits, but has also been universally popular among Catholics in general, often serving as the model for religious retreats conducted by other orders of the church. The book consists principally of meditations, prayers, and self-examinations, designed to perfect the spiritual life through emphasis upon service to Jesus Christ above all else. The *Constitutions*, although changed by Ignatius a number of times during his lifetime, has never been modified in any essential particular since his death and is still the recognized rule of the Society. Ignatius was beatified by Pope Paul V in 1609 and was canonized in 1622 by Gregory XV. His feast is celebrated July 31. Well known portraits of him were painted by Rubens and Titian, and Catholic schools have frequently been named in his honor. W. G. D.

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**IGNEOUS ROCK**, one of three main groups of rocks composing the earth's crust, the other two being sedimentary and metamorphic. Igneous rocks are those that have solidified from molten lava. This lava has its source in the molten, glassy **MAGMA** believed to exist at depths of from 30 to 40 miles. If this magma rises along fissures and solidifies before reaching the earth's surface, the igneous rocks formed are called *intrusions*. These igneous intrusions are often exposed as a result of the removal of the overlying rocks by processes of **EROSION**. If the magma rises to the surface and there overflows as lava, the igneous rocks so formed are called *extrusions*. Igneous rocks are abundant and widely distributed. They vary greatly in texture and in mineral composition. For a more extensive treatment of igneous rocks, see **ROCK, Igneous**; **GEOLOGY, Petrology**; **DIKE**.

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**IGNIS FATUUS**. See **WILL-O'-THE-WISP**.

**IGNITION, MECHANICAL**, the firing of a combustible substance or gaseous mixture, as in a gasoline or diesel engine. The electrical ignition system of a modern gasoline engine contains a switch, wiring, coil, and spark plugs to furnish the electrical spark, the source of which is a storage battery or magneto.

There are two methods of electrical ignition; the "jump spark" high tension system that employs spark plugs, and the "make-and-break" low tension system used mainly by marine and stationary engines. The latter type employs a pair of points for each cylinder, one point being movable, and which moves away or breaks contact in generating a spark.

*Compression ignition* is employed by diesel engines. Heat generated by high compression of air ignites a vaporous oil spray pumped through an injection nozzle at the proper instant.

*Spontaneous ignition* is the firing, without artificial or intentional stimulation, of a substance or gas. See **COMBUSTION**; **EXPLOSIVE**; **INTERNAL COMBUSTION ENGINE**.

**IGNORANCE**, in law, is a lack of knowledge of the existence of a fact or rule of law. Although it is technically distinguished from error and mistake, the distinction is slight and somewhat specious.

*Ignorance of fact*, in civil law such as with respect to a contract, may be the basis of relief in equity, where such fact could not be ascertained by reasonable diligence and it is essential to the contract, particularly where the other party has knowledge and deliberately withholds it. (See **FRAUD**.) In criminal law, ignorance of a fact cannot always be successfully pleaded as a defense. For example, is a man guilty of adultery, having innocently married a woman without knowledge that she has a husband living? There have been a number of cases of convictions in such instances. However, it is now fairly well settled

that ignorance of fact is a good defense where such fact must exist in order for there to be an offense, although there are many exceptions.

*Ignorance of law* is generally no defense in criminal proceedings, but the maxim that it is no excuse is not universally applied; there are instances when the existence of ignorance has affected the decision. Also in civil law, while there is the general rule that the courts will not give relief in a contract for a lack of knowledge of law, the rule is far from inflexible.

**IGOROTE**, or **IGOROT**, is the collective name for a number of related Malayan tribes inhabiting northern Luzon, Philippine Archipelago, signifying "mountain people." They are about 5 feet 4 inches in stature, medium-headed, with straight, coarse, black hair and brown skins. Their mountain-climbing habits give them peculiarly deformed feet. The culture of rice is the chief occupation, and both sexes work in the fields and upon the irrigation ditches. They differ from most Philippine tribes in the maintenance of public barracks for girls where trial marriage is practiced, and the government of villages by a council instead of headmen. See **PHILIPPINE ISLANDS**.

**IGUACÚ**. See **IGUASSU**.

**IGUALA**, town, SW Mexico, in the state of Guerrero, about 22 miles S of Taxco. Iguala, a market town, is notable as the "cradle of Mexican independence" where the Plan of Iguala was proclaimed in 1821, guaranteeing unity, religion, and independence. (See **MEXICO**.) The plaza of Iguala is notable for its tamarind trees. Silver mines here are among the first exploited by the Spaniards. Pop. (1940) 12,756.

**IGUALADA**, Latin *Aqua lata*, town, Spain, in the province of Barcelona, at the SW foot of the Monserrat, on the Noya River, 32 miles WNW of Barcelona. Igualada lies in a rich agricultural district and has textile, cement, iron, and wine industries. Features of interest are the ruined circular walls of the town and the near-by Benedictine monastery of **MONSERRAT**. Pop. (1940) 15,311.

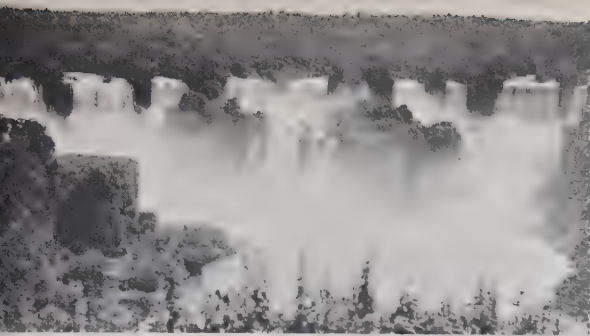
**IGUANA**, an herbivorous **LIZARD** belonging to the family *Iguanidae*. Several genera of iguanas are recognized, some of them reaching a remarkable length. The common species, *Iguana iguana*, is from five to six feet long and lives in trees throughout tropical America. The neck and back are furnished with a high crest, which is made up of separate spines. A similar row of spines occurs beneath the chin. The body and tail are long and compressed, and with the latter the iguana can give severe blows. The flesh is greatly esteemed as food, and to obtain it the iguanas are captured with nooses as they repose on the branches of trees. To the family *Iguanidae* belong a number of allied forms, such as the horned toad and the basilisk.

**Galápagos Land Iguana**, which inhabits interior of island, sometimes attains a length of four feet

CY LA TOUR & SON







EWING GALLOWAY

### Iguassú Falls on the Brazil-Argentine border

**IGUASSÚ**, or **Iguacu**, territory, SW Brazil, bordering the Misiones Province of Argentina; area 25,426 sq. mi.; pop. (1944 est.) 93,200. Iguassú is one of the federal territories established in 1943 along the Brazilian borders. The president of Brazil administers the territory; Foz do Iguassú is the capital.

**IGUASSÚ FALLS**, or **Iguassu**, Portuguese **Foz do Iguassu**, town, SE Brazil, in the state of Rio de Janeiro; on the Iguassú River at the Iguassú Falls, opposite Puerto Aguirre, Argentina. The Brazilian town, a growing tourist center, may be reached by a highway. It is a stop on the Pan American Airways and a Brazilian air line. Pop. (1940) 20,854.

**IGUASSÚ FALLS**, or **Victoria Falls**, in the Iguassú River in NE Argentina where the river forms the boundary between Brazil and Argentina. A huge semicircle of cascading water stretches 8,860 feet from shore to shore, a width twice as great as that of Niagara Falls. The highest falls are 327 feet and the lowest 215 feet, an awe-inspiring spectacle deep in the jungle. A hotel and a motor highway have been provided for tourists.

**IGUVIUM**. See **GUBBIO**.

**IHRIGIZING**, or **SILICONIZING**, in metallurgy, a process for impregnating iron and steel with silicon. A surface so treated, containing about 14 per cent silicon greatly improves the resistance of the steel to corrosion, heat, and wear. Silicon impregnated articles are resistant to nitric, sulfuric, and hydrochloric acid. Forged, rolled, or cast, low carbon steel parts with low sulfur content are suitable for siliconizing. In the ihrigizing or siliconizing process, the iron or steel is subjected to the action of silicon carbide and chlorine at temperatures of 1700°–1850° F. Parts are processed in a rotary or pot type furnace. Chlorine gas is added when the parts are at processing temperature. It is believed that the chlorine liberates the silicon from the silicon carbide in the nascent form, whereupon it diffuses immediately into the article to be treated. A silicon impregnated surface of 0.025 to 0.030 inch is usually produced on low carbon steel in two hours. See **ANTICORROSION PROTECTION**.

J. E. FOSTER

**IJSSEL MEER**, lake, the Netherlands, formed by the construction of the Afsluit Dike across the northern end of the Zuider Zee, between the island of Wieringen and the W coast of Friesland Province. The lake is a result of the project to drain the Zuider Zee and reclaim 523,000 acres of land, creating a new province in the Netherlands. Four areas, in the northwest, northeast, southeast and southwest, are to be enclosed by dikes and drained, leaving a greatly shrunken interior lake to receive the fresh waters of the IJssel River. A law instituting the program was passed in 1918, and the work was begun in 1920. Upon the completion of the 15-mile dike in 1929, drainage of the 50,000-acre Wieringermeer (northwest) polder was begun and accomplished in 1930. In 1932 the first crops were planted, and cattle grazed where water had rolled two years before. The Noordoost (northeast) polder was only partly drained at the outbreak of World War II, but in spite of the German occupation the work was completed by August, 1941. It comprises a total of 125,000 acres, of which 50,000 were under cultivation in 1946.

### Ilford

In April, 1945, the protective dikes of Wieringermeer polder were blown up at two points by the Germans. The Dutch repaired the dike by August, 1945, and a careful drainage program made possible partial replanting of the land in the summer of 1946. The Netherlands government in 1950 appropriated Marshall Aid counterpart funds for a reclamation program which is not expected to be completed until 1980. The program includes reclamation of the Zuidwest polder (135,000 acres) and the Zuidoost polder (240,000 acres), and construction of roads and canals. See **ZUIDER ZEE**.

D. M.

**IJSSEL RIVER**, or **Yssel**, the Netherlands, flows for a length of 70 miles through the provinces of Gelderland and Overijssel. The northernmost arm of the Rhine, it branches from the Neder Rijn east of Arnhem and flows northeast and north past Zutphen, Deventer, and Zwolle, emptying into the **IJSSEL MEER** (Zuider Zee) below Kampen.

**IKÁRIA**. See **SPORADES ISLANDS**.

**IKHNATON**, the title assumed by **Amenhotep IV**, Egyptian king who reigned c. 1375–c. 1358 B.C. He was the son of Amenhotep III and the husband of Nefertiti. Ikhnaton spent most of his reign in promoting the cult of Aton, the sun, as supreme god of Egypt. He broke with the old priesthoods, especially those of Amon, his father's god, and changed his own name to Ikhnaton, which means "Aton rests." He founded three cities for Aton, one in Nubia, one in Syria, and the last, his new residence, in Egypt (Akhetaton, now Tell-el-Amarna). His religious fanaticism aroused much secret hostility from the people and the old priesthoods, and the cult of Aton was destroyed after he died.

**IKI ISLAND**, Japan, off the NW coast of Kyushu, area 51 sq. mi.; pop. (1946 est.) 52,000. Iki is roughly circular, and most of its surface is a low plateau some 500 feet above the sea. There is an anchorage at Mushozu, on the southwest coast. Iki, with the Tsushima Islands, holds a highly strategic position in the southern entrance to the Sea of Japan. It was in this vicinity that one of the world's decisive battles, the destruction of the Russian fleet by the Japanese under Admiral Togo, occurred in 1905 in the Russo-Japanese War. Iki is mentioned in the very earliest annals of Japan as having been one of the outlying islands first occupied by the Yamato people when they arrived from the south and founded the Japanese empire some 26 centuries ago. Japanese garrisons on Iki were overwhelmed in an eruption of the Toi tribe from the continent in 1019, and by the Mongol hordes, 1274 and 1281, in Kublai Khan's abortive efforts to invade Japan.

**ILAGAN**, a municipality, Philippine Islands, on Luzon, capital of the province of Isabela, at the junction of the Cagayan and Abuluan rivers; on the main highway, 85 miles SE of Aparri and 200 miles NNE of Manila. The town has road and water connections with Manila and Bayombong and is an industrial and trade center. Pop. (1948) 35,384.

ÎLE. See **ISLE**.

**ÎLE-DE-FRANCE**, ancient province of France, which in 1791 was divided to form the department of Seine, the greater part of the departments of Seine-et-Oise, Seine-et-Marne, Oise, and Aisne, and a small portion of Nièvre and Loiret. Its former capital was Paris. The most able of its dukes (who took the title of dukes of France) was Hughes Le Blanc or Le Grand, who exercised sovereign power under the Carolingian kings, Louis IV and Lothair. His son, **HUGH CAPET**, founded the Capetian dynasty.

**ILEUM**. See **INTESTINE**; **DIGESTION**.

**ILEX**. See **HOLLY**.

**ILFORD**, municipal and parliamentary borough, SE England, Essex, on the Roding River, a residential suburb seven miles NE of London, including a part of Hainault Forest. It has a 12th century hospital founded in Stephen's reign by Adeliza, abbess of Barking. There are large paper mills, and photo-

graphic supplies are manufactured. Little Ilford, on the opposite side of the river, was incorporated in the borough in 1926. Pop. (1950 est.) 186,120.

**ILHA GRANDE** lies off Brazil in the Bay of Angra, 68 miles WSW of Rio de Janeiro. The island is about 15 miles long and 8 miles wide. The town of Santa Anna is on its west side.

**ILHÉUS**, city and port, Brazil, in the state of Bahia, on the Atlantic Ocean, 125 miles SW of Salvador. The port has an important coastwise trade. Pop. (1950) 23,006.

**ILI RIVER**, Central Asia, rises in NW Sinkiang, China, in the Tien Shan, on the N slope of Kash Katur (11,600 ft.), E of Issyk Kul (lake). Flowing east then north, it meets the Kunges and turns west, passing close to Kulja (Ining), in Sinkiang, and entering the Kazakh Soviet Socialist Republic near Kodjiger. The river twists northwest and passes through desert and marshes before it empties by several mouths into Lake Balkhash. The Ili is navigable for large craft only between Ilisk and Lake Balkhash; for rafts and small boats, up to Kulja and a short distance beyond. The river's total length is 900 miles; the chief tributaries are the Kash, Chilik, and Charyn. It is known as the Ili after the junction of the two head streams, the Tekes and Kunges, at the head of the Kulja Valley.

**ILIAD, THE**, first and greatest of the Homeric epic poems, deals in 24 books with the semi-legendary war of the Greeks against Ilium. The Iliad and ODYSSEY were traditionally attributed to HOMER and his name is still conventionally associated with them, though it is now disputed whether he was the actual author, and whether the Iliad is a homogeneous whole or a series of ballads or rhapsodies on episodes in the TROJAN WAR, united into a continuous poem. See HOMERIC CONTROVERSY.

The central theme of the Iliad is the "wrath of ACHILLES." The Greeks' most powerful champion deserts them when the Greek leader AGAMEMNON robs him of BRISEIS, a Trojan girl captured during the siege. The defection of the hero is followed by calamity for the Greeks, but Achilles rejects their pleas for assistance until his friend Patroclus, whom he had permitted to re-enter the battle, is slain by the Trojan hero, Hector. Achilles' anger now turns against the Trojans. Clad in new armor, specially wrought by HEPHAESTUS, he returns to the siege, routs the Trojans and, having slain Hector, attaches his body to his chariot and drags the corpse around the walls of the besieged city. The story ends with a description of the games and ceremonies attending the funeral of Patroclus.

**ILIAMNA LAKE**, Alaska, is connected with Bristol Bay by the Kwichak River. The largest lake in Alaska, it is 75 miles in length and 24 miles in breadth. The village of Iliamna (pop. 30) is located on the shore and is served by the Alaska and the Canadian Northern air lines.

**ILIGAN**, municipality, Philippine Islands, Mindanao, Lanao Province, in the SE angle of Iligan Bay, on the Iligan River, which traverses a fertile plain and drains the large inland Lake Lanao. Iligan is the seat of extensive trade, especially in spices, rice, and hemp. It has an excellent harbor. Pop. (1948) 25,725.

**ILION**, village, central New York, in Herkimer County, on the Mohawk River, the New York State Barge Canal, and the New York Central Railroad; 12 miles SE of Utica. The first permanent settlement was made in Ilion in 1828. Office equipment and supplies, firearms, and ammunition are the principal manufactures of the industrial village. Pop. (1950) 9,363.

**ILIUM**. See TROY.

**ILKESTON**, market town and municipal borough, England, in Derbyshire, nine miles NE of Derby, near the Erewash River and Canal. Cotmanhay forms the northern part of the borough. Ilkeston has a 13th century Norman church. Hosiery, lace,

needles, earthenware, stoneware jars, and bricks are manufactured. There are iron works and ironstone and coal mines. Pop. (1951) 33,674.

**ILKLEY**, health resort and urban district, NE England, Yorkshire, in the West Riding, in the Wharfe River Valley, including the 1,500-acre tract of Ilkley Moor; 12 miles NW of Bradford and 18 miles NW of Leeds. Burley district was united with Ilkley in 1937. The town is built upon the site of the Roman fort, *Olicana*, a station on the way from Ribchester to Aldborough mentioned by Ptolemy. South of Ilkley on Rumbald's (Rumble's) Moor rise the mineral springs for which the town is famous. Besides several hydropathic institutions, there is a museum of Roman relics and an ancient parish church, which has been partially restored. Five miles north of Ilkley are the ruins of Bolton Abbey. Pop. (1951) 17,265.

**ILL RIVER**, France, the principal river of Alsace, rises in the Jura Mountains near Winkel, and flows NE, parallel to the Rhine, through the richest agricultural land of Alsace, from Mulhouse to Strasbourg, and enters the Rhine nine miles below Strasbourg. It is 112 miles long. Two important canals lead out of the Ill near Strasbourg, the Rhine-Rhône and Rhine-Marne.

**ILLAMPÚ**, sometimes called Mount Sorata, in W Bolivia, E of Lake Titicaca in the department of La Paz, the highest mountain of the Cordillera Real of the Andes; elevation 23,012 feet. There are two peaks, Illampú and Ancohuma, the latter being about 100 feet the higher. See ANDES MOUNTAINS.

**ILLANA BAY**, Philippine Islands, on the SW coast of Mindanao, opens on the Moro Gulf and is 40 miles wide from the westernmost point in Coto-bato Province to Flecha Point in Zamboanga Province. It is separated by an isthmus 15½ miles wide from Panguil Bay, an inlet of Iligan Bay on the north side of Mindanao. Illana Bay receives a number of rivers.

**ILLE-ET-VILAINE**, department, N France, bounded by the English Channel and the department of Manche on the N, Mayenne on the E, Loire-Inférieure on the S, and Morbihan and Côtes du Nord on the E; area 2,697 sq. mi.; pop. (1954) 586,812. The Ille and the Vilaine rivers flow from the north and east, respectively, to join at Rennes. The Couesnon empties into the Bay of St. Michel in the north, while the Rance forms an estuary between Dinan and St. Malo on the English Channel. The department is a plateau with hills of low elevation. The soil is thin and the climate wet; agriculture is limited to such crops as buckwheat, rye, oats, and potatoes. Hemp, flax, and some tobacco are grown, and dairying and cattle raising are important. Iron and lead are mined. St. Malo is an important fishing port, and oysters are exported, chiefly from Cancale. The capital is Rennes.

**ILLEGITIMACY AND LEGITIMACY**. Illegitimacy, in sociology, is the birth of children outside the sanctioned form of family life; in Western civilization the term is commonly applied to children born outside of lawful wedlock. The intensity of the problems created by illegitimacy vary with the customs, attitudes, and social conditions of the society in question. These problems usually involve the adjustments of the parents of illegitimate children, particularly mothers, to the conditions of living in a society which regards their behavior as immoral, as well as the problems of the illegitimate child, who enters life with a definite social handicap.

The conception of legitimacy or illegitimacy is a function of the type of family organization peculiar to a given culture, and it usually becomes part of a constellation of values related to religion and property. There are certain folk and primitive groups for instance, which welcome all children born to their members. This is particularly true of matriarchal societies. Although it is true that the forms of marriage which receive social sanction vary from one



group to another and within the same group at different periods in its history, conformity to the sanctioned modes has been at all times the criterion for fixing the place of the mother and her child within the group. The odium of illegitimacy, and the penalties attached to it in our own society, will therefore be positively correlated with the strength of the patriarchal, monogamous family (the sanctioned family relationship in our group), and the constellation of valuations and beliefs surrounding family life.

**Responsibility for Support.** Until recently, western society has viewed illegitimacy as a transgression of social and legal standards. Harsh punishment in terms of social condemnation was meted out to the mother and all legal rights were denied to the child. The English and American common law designate the illegitimate child as *filiius nullius*, the child of no one, without name, without kin, and without claim on anyone for support. The duty of support, however, was a little later imposed upon the mother, and not until recent years has cognizance been taken of the existence of the father and an effort made to compel him to contribute to the child's support. The Napoleonic Code which was until recently the law in France and Italy, forbids inquiry into the paternity of a child of an unmarried mother. In England, the mother is held responsible for the child's support and by subsequent legislation the father is compelled to contribute. In the United States, the relation of the mother to her illegitimate child is the same as her relationship to her legitimate child. The state of Minnesota, in 1917, led the way in legislation which also required a similar degree of responsibility from the father.

The early measures taken by the state in regard to the protection of the unmarried mother and her child grew out of the poor-law legislation and had as their objective the protection of the state from the burden of the dependency of the illegitimate child. The tendency of later legislation has been to recognize the responsibility of the state in securing adequate care for the illegitimate child, by compelling support by the father, or by making provision for the granting of aid directly by the state. This change in legislation may be correlated with a decline in the functions of the patriarchal family as a social institution, and the rise of the concept of the service state.

**State Protection in Foreign Countries.** The most advanced legislation looking to the provision for unmarried mothers and their children has been enacted in Norway, under the Castberg laws, where the state has accepted the responsibility for the protection of unmarried mothers and their infants. If support cannot be secured from the father the state supplies financial assistance. Particular attention is given to securing proper care for the mother and the state itself takes the initiative in establishing paternity. Both parents are held to the same degree of responsibility for the care of the illegitimate child as for the legitimate child, children born out of wedlock having the same rights to their father's name as do legitimate children, as well as full inheritance rights.

Legislation in the United States has been more conservative, but there is now a tendency to make conventional guardianship conform to biological parentage. In Russia, after the Bolshevik Revolution, an attempt was made to change the existing institutional framework. The patriarchal family was abolished, and with it the whole concept of legitimacy or illegitimacy. With the present change in Russian policy concerning the family, these reforms have not persisted in their original form.

**Social Aspects of Illegitimacy.** Aside from the legal problems involved in illegitimacy, there are also a host of social problems. Studies to determine the causes of illegitimacy show that most unmarried mothers come from the lower income groups, are of rather low intelligence, and often have been themselves products of broken homes or of unhappy family situations.

The illegitimate child falls prey to a variety of ills. First his actual chance for survival is poor because of the activity involved in trying to keep such births secret. Quack maternity and adoption homes do a lucrative business by catering to mothers of illegitimate children. In cases where the unmarried mother keeps her child, she often is stigmatized by the group. Further, problems of support and maintenance as well as of social condemnation constitute a social handicap which is difficult to overcome. Illegitimate children are more than likely children who suffer from economic want, and lack of educational opportunities. As such, many of the opportunities for social advancement are denied to them. In this country some attempts have been made to negate some of the more obvious inequalities which face the illegitimate child through changes in bastardy proceedings, and the licensing of maternity and adoption agencies. The problem, however, is one which cuts deep into the fabric of our society, and any significant change in the concept of illegitimacy is one which will of necessity be correlated with basic re-evaluations in the structure of social institutions.

Illegitimacy has also constituted a problem in reference to property rights and inheritance. Under the common law only legitimate children may be heirs. See FAMILY; MARRIAGE; SOCIAL INSTITUTIONS; CHILD ADOPTION; CHILD WELFARE; ORPHANAGE; HEIR; INHERITANCE.

GERRY CIVIN

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**ILLER RIVER**, Germany, flows N through Bavaria from its source in the Tyrol; forms part of the boundary between Bavaria and Württemberg; and enters the Danube near Ulm, after a course of about 100 miles.

**ILLICIUM**, a genus of shrubs of the MAGNOLIA family which includes the Chinese star ANISE. The flowers are large and showy, with many petals, of a yellowish or purplish hue. There are several pistils, each with a carpel at its base; and these, in the mature fruit, lie in a ring about a common center, forming a many-pointed star, each opening at the top, for the release of the single seed. The odor is aromatic, somewhat anise-like or clovelike, and the fruits are used as a carminative, etc., in medicine.

One species of *Illicium*, *I. floridanum*, in the extreme southern United States, has handsome, dark, maroon-colored blossoms, and thick, evergreen leaves, from which emanates a faintly anise-like odor.

**ILLILOUETTE FALLS**, California, in YOSEMITE NATIONAL PARK; a 370-foot cascade formed by the waters of Illilouette Creek as it courses through the canyon of the same name. The fall reaches its maximum volume in May and June after the melting of the winter snows.

**ILLIMANI**, mountain of the ANDES, in the Cordillera Real of Bolivia, E of La Paz. One of the highest mountains of the range, its principal peak is snow-covered and has an altitude of 22,579 feet.

**ILLINIUM**, the name given to element number 61 by B. Smith Hopkins. The element was identified by J. A. Marinsky and L. E. Glendenin in 1945 as one of the fission products of uranium. Two radioactive ISOTOPEs of illinium have been isolated, one of atomic weight 147 with a half-life period of 3.7 years and the other of atomic weight 149 with a half-life period of 47 hours.

# ILLINOIS

## The Prairie State

Meat packing and manufacturing, coal mining and corn growing help make Illinois commercially great



ILLINOIS DIVISION OF DEPARTMENT REPORTS

**ILLINOIS**, one of the N central states of the United States, bounded on the N by Wisconsin; on the E by Lake Michigan, Indiana, and Kentucky; on the S by Kentucky; and on the W by Missouri and Iowa; area 56,400 sq. mi., including 453 sq. mi. of inland water; pop. (1950) 8,712,176. Illinois is 385 miles long and 218 miles wide. The Wabash and Ohio rivers on the southeast and south and the Mississippi River on the west mark its boundary. Illinois is 24th among the states in area and 4th in population. The state name is derived from the Algonquian *illini* (men). The nickname is the "Prairie State" and the motto is "State Sovereignty—National Union." The state flower is the violet. Illinois was the 21st state to enter the Union. Springfield is the capital. See map in Atlas, Vol. 20. For state flag in color, see FLAG.

**Topography.** Illinois lies in the valley of the Mississippi River and the basin of the Great Lakes. Situated in the great Middle West prairie region, Illinois is generally level, with an undulating surface which slopes gently toward the south and southwest, making it the most level state with the exception of Delaware and Louisiana. The average elevation of the state is about 600 feet. The lowest point is at CAIRO (267 ft.) and the highest point, the Charles Mound (1,241 ft.), in the northwest corner on the Illinois-Wisconsin boundary line. There are two noteworthy elevations—one extending from the northwest corner and running southeast to the Illinois River, a projecting portion of the hilly Wisconsin area; the other crossing the state from east to west, in the extreme southern part, an extension of the Ozark range.

The drainage is mostly from the north and northeast to the southwest into the Mississippi River, although a few rivers flow south and southeast into the Wabash and the Ohio. The Illinois River, formed by the junction of the Des Plaines and the Kankakee rivers, is the most important river of the state. It rises in northern Illinois and flows in a southerly direction for some 273 miles, draining over half the area of the state. The main tributaries of the Illinois River, in addition to the Kankakee and the Des Plaines, are the Fox, the Vermilion, the Mackinaw, the Spoon, and the SANGAMON. Other rivers of Illinois include the ROCK RIVER in the north and the KASKASKIA, the Big Muddy, the Little Wabash, and the Embarrass in the south. The Little Wabash and the Embarrass rivers empty into the Wabash in the southeast part of the state.

**Climate.** Illinois has a humid continental climate. It experiences a long, hot summer, and, especially in

the north, severe winters. The average annual temperature over a period of 55 years was 52.8° F. Extremes of 115° and -35° have been recorded. Because Illinois lies directly within the path of the storm tracks it has marked and rapid weather changes. The average annual precipitation increases from north to south: in the north 33.39 inches is normal; in the central part of the state, 36.58 inches; and in the south 44.22 inches. The state average is 36.70. Unmelted snowfall amounts to 21.5 inches. The rainy season occurs during the summer. The prevailing winds are from the south and southwest with the greatest amount of wind movement in March and the least amount in August. Local wind squalls and small tornadoes are occasionally damaging. The average number of cloud-free days is 157. The growing season, which varies from 150 days in the north to more than 200 days in the south, extends from May in the north, and mid-April in the center and south, to October.

**Plants and Animals.** The first settlers in Illinois found almost half the state wooded, with great prairies running between the creeks and other waterways, their surface lush with waist-high grasses and liberally bedecked with wild flowers. For the pioneers, Illinois marked the transition from the wooded lands of the East to the treeless plains of the West. Since it was their first encounter with giant stretches of treeless grasslands, the state was nicknamed for the prairie, although westward were lands more worthy of the title than the semi-wooded surface of Illinois. Lumbering activities reduced the forests of Illinois from their original extent of 42 per cent to little more than 5 per cent. There are two national forest areas, consisting of 812,654 acres, which have been conserved at the southern tip of the state. In Ogle County, less than 50 miles from the Wisconsin border, is the southernmost stand of the northern white pine and in southern Illinois, in the region known as "Egypt" are swamps of southern cypress. The state tree is the native oak.

Colorful varieties of wild flowers abound within the state. The wild hyacinth, the common cattail, and the swamp buttercup are found growing unprotected and unshaded in the fields and along the roadsides. In mid-summer the Illinois River and its adjacent lakes become a land of pale yellow lotuses blossoming acre upon acre, slantwise through the state. The waxy blossoms stand from two to four feet above water and perfume the air for miles around.

Big game is extinct in Illinois, but deer, rabbits, squirrels, raccoons, opossum, gray and red foxes,



beavers, otters, badgers, skunks, and muskrats and game birds such as cock pheasants, geese, ducks, and quail abound in rural sections of the state. Western meadow larks, buntings, cardinals, mockingbirds, wrens, and orioles are found singing in the hot Illinois summer sunshine. There are ocean birds on Lake Michigan and egrets along the Illinois River. The state bird, chosen by the school children of Illinois, is the cardinal.

PEOPLE

**Population.** According to the Federal census for 1950 the population of Illinois was 8,712,176, an increase of 814,935, or 10.3 per cent, over 1940 (compared with an increase of 3.5 per cent during 1930-1940). The urban population was about 78 per cent of the total, compared with 73.6 per cent in 1940. Illinois, third in population among the states in 1940, was fourth in 1950.

| PRINCIPAL CITIES           | POPULATION  |             |
|----------------------------|-------------|-------------|
|                            | Census 1940 | Census 1950 |
| Chicago.....               | 3,396,808   | 3,620,962   |
| Peoria.....                | 105,087     | 111,856     |
| Rockford.....              | 84,637      | 92,927      |
| East St. Louis.....        | 75,609      | 82,295      |
| Springfield (Capital)..... | 75,503      | 81,628      |
| Evanston.....              | 65,389      | 73,641      |
| Cicero.....                | 64,712      | 67,544      |
| Decatur.....               | 59,305      | 66,269      |
| Oak Park.....              | 66,015      | 63,529      |
| Joliet.....                | 42,365      | 51,601      |

**Education.** Education is free and compulsory for children between the ages of 6 and 16. Higher education is offered by a large number of colleges and universities, junior colleges, normal schools and teachers' colleges, and professional and technological schools. The three great universities of the state are the University of Illinois, at Urbana-Champaign, with a branch at Chicago; Northwestern University, at Evanston; and the University of Chicago.

Among the other institutions for higher education are: Augustana College, at Rock Island; Aurora College, Aurora; Bradley Polytechnic Institute, Peoria; Carthage College, Carthage; De Paul University, Chicago; Elmhurst College, Elmhurst; Eureka College, Eureka; Greenville College, Greenville; Illinois College, Jacksonville; Illinois Institute of Technology (formed in 1941 by the merger of the Armour Institute of Technology and Lewis Institute), Chicago; Roosevelt College, Chicago; Illinois Wesleyan University, Bloomington; James Millikin University, Decatur; Knox College, Galesburg; Lake Forest College, Lake Forest; Loyola University, Chicago; MacMurray College for Women, Jacksonville; McKendree College, Lebanon; Monmouth College, Monmouth; Mundelein college, Chicago; North Central College, Naperville; Olivet College, Olivet; Rockford College, Rockford; Shurtleff College, Alton; and Wheaton College, Wheaton. There are teacher training schools at Chi-

cago, De Kalb, Carbondale, Charleston, Macomb, Normal, Evanston, River Forest, and Peoria.

**Public Welfare.** The state penal and correctional institutions are: penitentiaries at Joliet, Menard, and Stateville; state reformatories at Pontiac; St. Charles School (for boys) at St. Charles; the state training school for girls, at Geneva; the state farm at Vandalia. There are hospitals for the insane at Chicago, Kankakee, Elgin, Jacksonville, Anna, East Moline, Peoria, Alton, Chester, and Manteno. There is a state school and colony for the feeble-minded, at Lincoln; a colony for the insane, feeble-minded, and epileptic, at Dixon; a soldiers' and sailors' home at Quincy; a soldiers' widows' home at Wilmington; a soldiers' orphans' home at Normal; schools for the deaf and the blind, at Jacksonville; an industrial home for the blind, at Chicago; and an eye and ear infirmary at Chicago.

ECONOMIC LIFE

**Manufacturing.** Illinois is one of the leading manufacturing states of the nation. In addition to ample railway facilities the state has the advantage of cheap water transportation afforded by the Mississippi and its navigable tributaries and by the Great Lakes. In the latter decades of the 19th century, as industry moved westward, manufacturing in Illinois rose to great proportions far exceeding agriculture in value. By far the most important industry is slaughtering and meat packing, in which Illinois is the leading state in the nation. The industry is located almost entirely in Chicago, which is the world's greatest packing center. Illinois, in 1947, ranked first in the manufacture of agricultural implements and electrical equipment, third in furniture manufacturing, fourth in the tanning industry, and fifth in footwear production. Other leading industries of the state include the manufacture of iron and steel products, bread and bakery products, tin cans and other tinware; radios, tubes, and phonographs; paints, varnishes, and lacquers; and processed fruits and vegetables. Highly important also are commercial printing and publishing, petroleum refining, and the manufacture of clothing, footwear, blast furnace products, paperboard containers, machine shops and flour products, and household furniture.

Approximately three-fourths of the state's manufactured goods are produced in the metropolitan area of Chicago. Of the many and diverse industries here, the leading ones are food products, steel, machinery, printing and publishing, clothing and farm implements. Among the other notable manufacturing cities of the state, Rockford is known for its furniture, Moline for agricultural implements, Elgin for watches, Kewanee for boilers. At Rock Island the Federal government operates an arsenal which furnishes employment to an average of 2,000 workers in peacetime, more in wartime.

**Agriculture.** The greatest source of wealth in the state, next to manufacturing, is agriculture. From early days farming in Illinois has varied greatly in the

Chicago campus of Northwestern University

NORTHWESTERN UNIVERSITY



Illini Union Building at University of Illinois

UNIVERSITY OF ILLINOIS



## Illinois

different sections of the state because of soil variations and the range of climate from north to south. The soils are mostly of glacial origin, but in the river bottoms are deposits of alluvial silt, forming a dark, rich loam of unusual fertility. Because of an underlying stratum of clay, the rainfall is retained, necessitating costly systems of drainage. In the northeastern section of the state, dairying and truck farming have predominated; wheat growing, dairying, and poultry raising have been especially important in the southwestern section; in the extreme south cotton was grown extensively at various periods, but fruit and other specialized crops have predominated more recently.

Corn has always been the most important crop grown in Illinois. The first varieties of corn were obtained from the Indians or brought from New England. After the Civil War, better varieties of corn, especially suited to the state's climate and soil, were developed. Of these newer varieties, the most notable was Reid's Yellow Dent. In the 1930's, hybrid corn, smaller-stalked but much higher yielding, was planted in the state. By the end of World War II, nearly all of the corn grown in Illinois was of the hybrid variety. Illinois is exceeded only by the state of Iowa in corn production. The value of the Illinois corn crop accounts for more than half of the total value of all crops cultivated in the state. In the production of oats, Illinois ranks after the states of Iowa and Minnesota. It leads in the production of soybeans, producing an annual crop more than twice that of any other state. An important percentage of the cultivable acreage is devoted to the growing of hay and pasture crops. Of considerable value to Illinois farming are the services of the University of Illinois.

### PRINCIPAL CROPS OF ILLINOIS

| CROP          | UNIT<br>(Thousands) | 1944-53<br>AVERAGE | 1954    | 1955    |
|---------------|---------------------|--------------------|---------|---------|
| Apples.....   | Bushels             | 3,082              | 2,260   | 1,500   |
| Barley.....   | Bushels             | 899                | 2,260   | 4,760   |
| Corn.....     | Bushels             | 462,296            | 458,568 | 523,992 |
| Hay.....      | Tons                | 4,111              | 4,577   | 4,636   |
| Oats.....     | Bushels             | 138,432            | 137,172 | 177,408 |
| Peaches.....  | Bushels             | 1,684              | 1,210   | 90      |
| Popcorn.....  | Pounds              | 41,072             | 39,600  | 27,000  |
| Potatoes..... | Bushels             | 1,075              | 360     | 440     |
| Soybeans..... | Bushels             | 81,614             | 89,074  | 100,510 |
| Wheat.....    | Bushels             | 34,004             | 46,964  | 51,220  |

Since the state possesses plenty of hay and corn, as well as good grazing land, livestock constitutes a valuable part of Illinois agriculture. The state ranks second and seventh in the number of hogs and cattle respectively. Horses still have a high value, despite a decline in their number since the year 1915. Hog production yields more than one-fifth of the total cash farm income. There are large numbers of dairy and beef cattle, and Illinois is one of the leading dairying states of the nation. Chicken and egg production is of large proportions. Exhibitors from all over the world come to the annual International Livestock Expositions held at the Chicago Stock Yards.

**Mining.** Illinois is one of the leading states in the value of mineral products. Coal, the chief mineral, long accounted for more than half of the total value of the state's mineral production. For a number of years only West Virginia and Pennsylvania have yielded more bituminous coal. The coal-yielding area of the state forms a part of the Eastern Interior Coal Field, which covers an area of approximately 35,000 square miles in the state. For many years Illinois has ranked first in the production of fluorspar. In 1905 the state produced 181,000 barrels of petroleum, and three years later the output rose to nearly 33,700,000 barrels. From this high point there was a steady decline until the late 1930's, when a new period of expansion began. In 1952 the mineral production of Illinois, valued at more than \$460



ILLINOIS DEVELOPMENT COUNCIL

**New Salem State Park** is a restoration of town where Lincoln spent six of his early Illinois years

million, was seventh among the states of the union.

### MINERAL PRODUCTION OF ILLINOIS

|                      | UNIT<br>(Thousands) | 1950   | 1951   | 1952   |
|----------------------|---------------------|--------|--------|--------|
| Cement.....          | Barrels             | 7,857  | 8,377  | 8,710  |
| Coal.....            | Short tons          | 56,290 | 54,199 | 45,780 |
| Fluorspar.....       | Short tons          | 154    | 204    | 188    |
| Lime.....            | Short tons          | 367    | 462    | 460    |
| Natural gas.....     | m. cu. ft.          | 13,285 | 11,425 | 10,183 |
| Petroleum.....       | Barrels             | 62,028 | 60,243 | 60,089 |
| Sand and gravel..... | Short tons          | 18,695 | 20,130 | 19,584 |
| Stone.....           | Short tons          | 17,911 | 19,298 | 22,334 |
| Zinc.....            | Short tons          | 26     | 21     | 18     |

**Fisheries.** With the Mississippi, Wabash and Ohio rivers forming so large a part of its boundaries, a frontage on Lake Michigan, and the entire Illinois River within its borders, the fishing industry of Illinois is considerable. About 35 varieties of edible fish are caught, principal among them, commercially, being European carp, buffalo fish, catfish, and bullheads. The lake fisheries yield pike, bass, salmon, trout, whitefish and sturgeon.

**Transportation.** The state has extensive means of transportation by both rail and water. Because of its central position, its rich mining and agricultural resources, its great volume of manufactures, and the favorable locations of Chicago and St. Louis, the two chief distributing centers of the Midwest, the railway facilities are unusually abundant. Two score railroads enter Chicago, which is generally considered the railroad center of the nation. Illinois, served by many of the most important rail lines in the United States, is crossed and crisscrossed by a network of railroad tracks. With more than 11,600 miles of railroad lines, Illinois ranks second to Texas in total mileage. In fact, there are more miles of railroad in Illinois, for each square mile of its size, than in any other state in the United States with the exception of Pennsylvania. There is an average of more than 21 miles of railroad for every 100 square miles of territory in Illinois. Transportation facilities are augmented by a network of electric lines, numerous bus companies, and trucking concerns.

The most important water transportation system of Illinois is that of the Great Lakes by means of Lake Michigan, of whose shore line 65 miles are within the state. Chicago, the state's only city port on Lake Michigan, is the world's greatest lake port. The lake is connected with the Mississippi River by the Illinois Waterway, which utilizes the Illinois River, the Des Plaines River, the Sanitary and Ship Canal, and the Chicago River. By means of this waterway and the Mississippi River, small ships, with a draft of nine feet or less, can travel from Lake Michigan to the Gulf of Mexico. The Hennepin Canal connects the Illinois River with the Mississippi in the northwestern part of Illinois. The Sanitary and Ship Canal, popularly known as the Chicago Drainage Canal, diverts





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**Lincoln Home at Springfield was the only one ever owned by Lincoln; here he lived from 1844 to 1861**

the water of the Chicago River from Lake Michigan, its natural outlet, to the Illinois River.

Extensive road-building programs have accompanied the development of the automobile. Illinois began, in 1919, construction of a state-wide system of paved roads. In 1948, there were 104,634 miles of highway in Illinois, of which 84,168 miles were paved; there were some 14,000 miles of heavy duty roads, a mileage exceeding that of any other state. Three transcontinental highways cross the state, U.S. highways 30 (the Lincoln Highway), 40, and 50.

Illinois has become the great crossroads of air traffic because of its central position and the great commercial importance of Chicago. Chicago is rapidly becoming the hub for the United States of the world's air traffic. The city is served by nine major air lines including the American, the Braniff, the Chicago and Southern, the Delta, the Eastern, the Northwest, the Transcontinental and Western, and the United lines. In the early spring of 1946 a transatlantic air service was inaugurated from Chicago, with scheduled stops in Ireland, England, Denmark, and Sweden.

**Tourist Attractions.** Illinois possesses a wealth of scenic beauty, of historic associations with the great of the nation, and many memorials to historic events which took place within its borders. Widely scattered throughout Illinois, the state parks are a system comprised of 40 separate reservations, aggregating nearly 30,000 acres. Perhaps the best known of these parks is the Starved Rock State Park near Ottawa on the south bank of the Illinois River. The park's name honors the heroic stand of a band of Illinois Indians, who, in 1770, chose to starve to death atop the sandstone bluff, which rises 160 feet above the water, rather than to surrender to their Indian enemies. Inextricably intertwined with Illinois is the name of the Civil War president of the United States, Abraham Lincoln. Lincoln shrines in the state include the New Salem State Park, an authentic restoration of the town in which Lincoln lived before moving to Springfield; Springfield, where he practiced law, established a home, the only one he ever owned and where he lived until 1861; and in Oak Ridge cemetery, in Springfield, is the most impressive memorial of all, the Lincoln tomb, which is visited by people from all over the world. The Pere Marquette State Park, near Grafton, marks the site where, in 1673, Marquette, the famous Jesuit explorer, and his companions encamped while investigating the Mississippi River. Rugged cliffs rising majestically above the Mississippi River, densely wooded areas, and attractive valleys are combined in the Mississippi Palisades State Park, one of the most delightful recreational areas in Illinois. The oldest park in the Midwest is the Black Hawk State Park, land which escaped the white man's plow to retain its natural primitive beauty. In the Ozark region of Illinois is the Giant City State Park, famous for its beauty and its historical connections with the Civil War. Fort Kaskaskia State Park symbolizes the colorful segment of Illinois history known as the French regime, when priests, explorers, and

traders roamed the state forests and prairies and French settlers built villages like those in their mother country. Other points of historic interest in Illinois include the Stephen A. Douglas tomb in Chicago and the Ulysses S. Grant home in Galena.

A. M. K.

#### GOVERNMENT

The third and present state constitution was adopted in 1870; eight amendments have since been added. The Gateway Amendment, approved by voters of the state in 1950 after several failures, made possible easier amendment of the constitution; previously, amendments had been very difficult under the constitution's provisions. The vote is granted to all citizens of the United States resident one year in the state, 90 days in the county, and 30 days in the election district. The state has the open primary, but there is a provision which prevents shifting from one party to another within a period of two years.

The General Assembly consists of a Senate of 51 members elected for four-year terms and a House of Representatives of 153—three from each senatorial district—chosen for two-year terms. Since each district elects three representatives a system of cumulative plural voting is permitted; each voter has three votes which he may give to one candidate or distribute among two or three. Senators are paid \$10,000 for each four-year term and representatives \$5,000 for each two-year term. A two-thirds vote of the elected members of each house overrides the governor's veto, which extends to any bill or item in an appropriation bill. A regular legislative session is held biennially in the odd year, beginning on Wednesday after the first Monday in January and ending on June 30.

The executive department is headed by a governor elected for a term of four years. Other state officials are the following: lieutenant governor, secretary of state, treasurer, auditor, attorney general, and superintendent of public instruction, all elected for four years except the treasurer, who has a two-year term. Other administrative officials are appointed by the governor with the consent of the Senate.

The judicial department is headed by the state Supreme Court, consisting of a chief justice and six associate justices, all elected from districts for nine-year terms. On the next level there are four appellate courts, the members of which are appointed by the Supreme Court. Next are the circuit courts, the state outside Cook County (Chicago) being divided into 17 circuits, each with three judges elected for six-year terms. Each county has a county court with one judge elected for a four-year term; each county with a population over 50,000 has a probate court. In addition, there are justices of the peace and police courts. Cook County and the city of Chicago have a special court system. Cook County has a superior

#### Illinois state capitol at Springfield

ILLINOIS DIVISION OF DEPARTMENT REPORTS

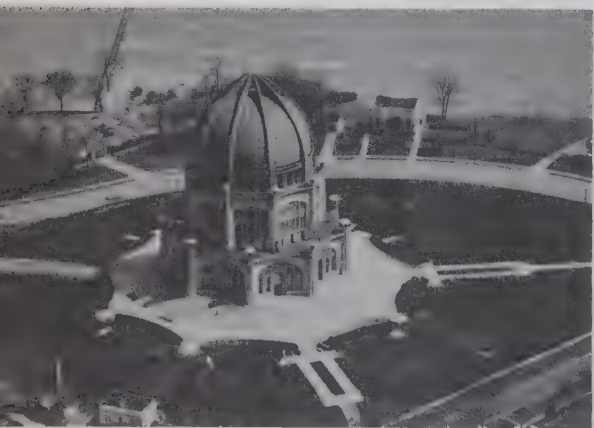


## Illinois



NORTON H. ZUCKERMAN

**Starved Rock**, towering 140 feet above the Illinois River, dominates the oldest of Illinois state parks



BAHA'I P.R. BUREAU

**Baha'i Temple** in Wilmette employs elements of many architectural styles in an harmonious pattern

**Pine Creek** winds through White Pine Forest State Park which contains only forest of kind in Illinois

HEDRICH-BLESSING



ILLINOIS DIVISION OF PARKS

**Pere Marquette State Park** commemorates French priest and explorer who visited the region in 1673



ILLINOIS DIVISION OF WATERWAYS

**Hardin Vertical Lift Bridge** across the Illinois leads to the state's only county without a railroad



BURLINGTON ROUTE

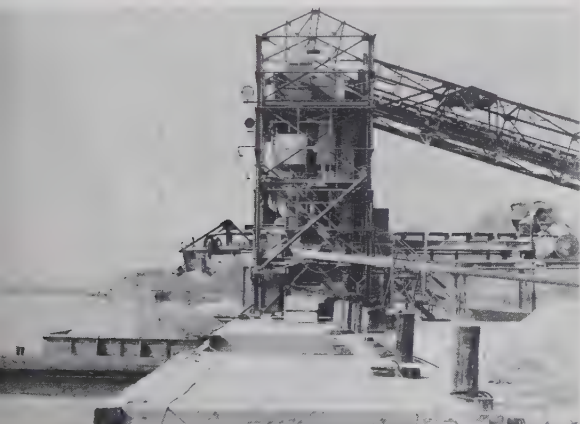
**Highway and Railroad** are squeezed between the Mississippi River and sheer Palisades near Savanna





**Chicago River, northern end of Illinois Waterway, divides Chicago, the industrial center of the state**

MORRIS AERIAL SURVEY



**Illinois Waterway is vital transportation route; this is loading berth of a gravel company at Joliet**

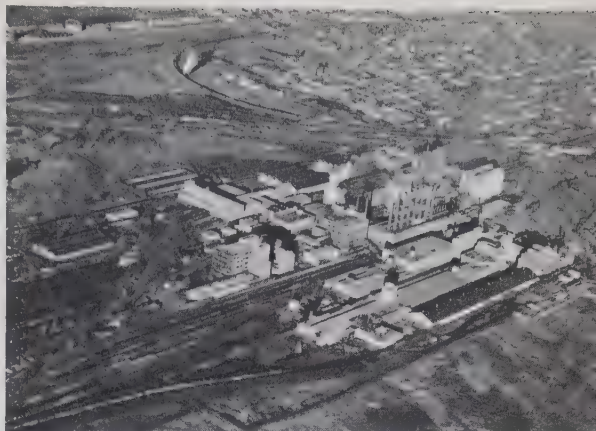
U.S. ARMY CORPS OF ENGINEERS



**Three-Bottom Plow turns over the rich soil of the rolling farm land in northwestern part of the state**

INTERNATIONAL HARVESTER CO.

## Illinois



MORRIS AERIAL SURVEY

**Refining Plant at Argo processes corn, the great crop of the Midwest, into many diversified products**

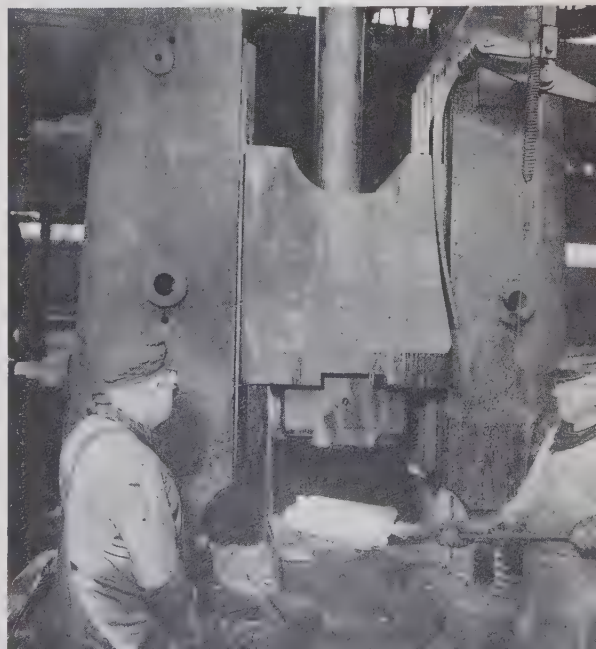


SHELL OIL CO.

**Oil Refinery at Wood River has been in production since 1917. Employees come from adjacent towns**

**Giant Forge with 12,000-pound hammer is a part of equipment in forge shop of tractor works at Chicago**

INTERNATIONAL HARVESTER CO.





**Motor fleet of the Illinois State Library Extension Service**

court of 28 judges and a circuit court of 20 judges, all elected for six-year terms. The county also has a county court, a probate court, and a criminal court, the last consisting of superior and circuit court judges designated for this function. In addition, Chicago has a municipal court of 37 judges—a chief justice and 36 associate justices—elected for six years.

Illinois is represented in the national Congress by two senators and 25 representatives. The Reapportionment Act of 1947 (the first since 1901) divided the state into 26 districts; the loss of one congressman as a result of the 1950 census made necessary a subsequent reapportionment of the state.

#### HISTORY

**French Exploration and Settlement.** The country of the Illinois Indians was first visited by LOUIS JOLLIET and Father JACQUES MARQUETTE in 1673. These two explorers passed down the Mississippi along the western edge of the present state; on their return trip they ascended the Illinois River, crossing the Chicago portage to Lake Michigan. Late in 1674 Father Marquette set out again to the Illinois country in order to establish a mission; after being delayed by illness he was forced to winter along the south branch of the Chicago River; finally on Good Friday, 1675, he opened his mission at the great village of the Illinois near STARVED ROCK, but a few days later the complete collapse of his health forced him to abandon his enterprise. In the winter of 1679–80 the great French explorer LA SALLE spent the winter at Pimiteoui (Lake Peoria); in the early spring he constructed Fort de CREVECOEUR, which was planned as a base for his projected expedition down the Mississippi. This French outpost was destroyed very soon afterward by a mutiny of the garrison during the absence of La Salle and his lieutenant TONTI. In 1682 La Salle returned to Illinois after his successful voyage down the Mississippi and established (1683) a new outpost at Starved Rock, near the great village of the Kaskaskia (an Illinois tribe); around this fort, which he called Fort St. Louis, he collected numerous tribes for mutual protection from the feared Iroquois. After the death of La Salle his Illinois concession was granted to HENRI "Iron Hand" TONTI and François Daupin de la Forest. In the winter of 1691–92 TONTI moved his post from the Rock to Pimiteoui. The new post, still under the name of Fort St. Louis but more often called Fort Pimiteoui, flourished for the greater part of a decade, but it was abandoned about 1699 when the French government forbade the western fur trade.

About 1700 the Catholic mission, which had been quite successful at Pimiteoui, was moved to the region near the entrance of the Kaskaskia River along the Mississippi, where most of the Illinois tribes were then congregating. Gradually a French settlement grew up along the east bank of the Mississippi be-

tween the Kaskaskia and the mouth of the Missouri, with two principal villages, CAHOKIA and KASKASKIA. In 1717 these settlements were annexed to the new province of Louisiana as the District of Illinois. In 1720 Fort de CHARTRES and three new villages were established, and the district was put under the government of a French military commandant and a civil judge. The Illinois country remained under French sovereignty until the territory was ceded to the British by the Treaty of Paris (1763), but the British flag was not raised over Fort de Chartres until 1765.

**Under British and American Flags.** For 13 years thereafter the Illinois country was governed by British military authority under conditions which discouraged further development. In 1774 it became a part of the province of Quebec. On July 4, 1778, during the American Revolution GEORGE ROGERS CLARK captured Kaskaskia and took possession of the whole Illinois country, which he organized as a county of Virginia—thus making Patrick Henry the first American governor of Illinois. At the end of the war the Illinois country was formally ceded to the United States. During the early years of American sovereignty the tiny French settlements in Illinois were left largely to their own resources; the NORTHWEST TERRITORY was formally organized in 1787 but American authority did not become effective in Illinois until 1790. About this time a few American settlers began to move into the region.

In 1800 the Illinois country was made a part of the new Indiana Territory, but in 1809 it was reorganized as the Territory of Illinois with the capital at Kaskaskia. The first territorial legislature convened in 1812. Settlement was seriously impeded by the Indian troubles which accompanied the War of 1812; the most notable incident of this period was the terrible massacre at Fort Dearborn on the site of Chicago. See DEARBORN, FORT.

**Early Years of Statehood.** At the conclusion of hostilities settlers came with a rush so that in 1818 the territory had the 40,000 population required for admission to the Union. The admission of the state occurred on Dec. 3, 1818. Kaskaskia was the first state capital, but in 1820 the state offices were moved to Vandalia; 20 years later the capital was moved again, this time to Springfield.

Most of the early settlers were southerners who established homes in the southern counties, many bringing their slaves with them. Shortly afterward another stream came from the northern states. An historic political controversy of early Illinois was caused by the attempt of the southerners in 1824 to amend the constitution to legalize slavery, in disregard of the Ordinance of 1787, which forbade slavery in the Northwest Territory; this proposal was rejected by a close vote, but a few slaves continued to be held in bondage for several decades. Meanwhile during the 1820's and early 1830's the Indian tribes were removed from the state to permit more rapid settlement; the last flurry of Indian warfare was the BLACK HAWK WAR of 1832.

In 1836 and 1837 the state embarked on a great \$10,000,000 scheme for the construction of railroads and other internal improvements. This project collapsed in the Panic of 1837, and the state was left heavily in debt. During the administration of Governor Thomas Ford (1842–46), however, the state was able to make arrangements with its creditors so that it was able to resume work on the ILLINOIS AND





ILL. STATE HISTORICAL SOCIETY  
At Starved Rock, named for an old Indian legend, La Salle constructed a fort in 1683

## High Lights of History



**Mormons**, who had moved across to Nauvoo from Missouri in 1839, were expelled from that city in 1846 after two years of what was practically civil war



**Lincoln-Douglas Debate at Charlestown in 1858**  
was one of series which paved the way for Lincoln's nomination and election to the presidency in 1860

**For all Purposes of Agriculture.**  
The lands offered for sale by the Illinois Central Railroad Company are equal to any in the world. A healthy climate, a rich soil, and railroads to convey to market the products of the soil—all combine to place in the hands of the enterprising farmer in the measure of independence.

[illegible]

**Grain and Stock Raising.**  
In the belt of corn and wheat production, the farmer stands re-  
markably first. His advantage for transportation and his  
reputation is well known to require comment here. Eastern raising  
lands in every part of the State are well adapted, and  
there can now be said of many of the large stock raisers of the country  
that no branch in industry offers greater inducement for  
investment.

**Hemp, Flax and Tobacco.**

Hemp and flax could be produced in all coastal countries and in the interior of Europe. The flax is not so common in the United States because of the "ampax" and it is not so common in the United States because of the "ampax" and it is not so common in the United States because of the "ampax".

**Fruit.**  
The fruit is a small, round, fleshy berry, about 1/2 inch in diameter, with a thick, red, fleshy, and juicy pulp. The seeds are small, round, and black, and are embedded in the pulp. The fruit is usually eaten fresh, but it can also be used in jams, jellies, and other preserves.

**Coal and Minerals.**  
The minerals of the district are in large measure of the same kind as those found in the rest of the country. The principal ones are coal, iron, lead, zinc, limestone, and marble. The coal is of the same quality as that of the rest of the country, and is found in the same places. The iron is of the same quality as that of the rest of the country, and is found in the same places. The lead is of the same quality as that of the rest of the country, and is found in the same places. The zinc is of the same quality as that of the rest of the country, and is found in the same places. The limestone is of the same quality as that of the rest of the country, and is found in the same places. The marble is of the same quality as that of the rest of the country, and is found in the same places.

### To Actual Settlers

ILLINOIS CENTRAL

Illinois Central Railroad, granted a charter in 1851, launched a vast program to attract settlers

MICHIGAN CANAL from the Illinois River to Chicago. This great project was completed in 1848. Another important event in Illinois history was the construction of the ILLINOIS CENTRAL RAILROAD in the early 1850's. Numerous other railways were built about the same time.

In 1839-40 the Mormons, driven out of Missouri, settled at Nauvoo, which they soon developed into one of the leading cities of the state. Owing to the political shrewdness of the leaders this sect gained many privileges and much political power. Religious prejudice and dislike for certain social practices of the Mormons (especially polygamy) led to conflict, culminating in the assassination of JOSEPH SMITH and his brother Hyrum at Carthage in 1844. Then began the remarkable exodus of the Saints under the leadership of BRIGHAM YOUNG across the western wilderness to Utah. See MORMONS.

A new state constitution was adopted in 1848; two provisions in this document indicated the growing importance of northerners in the population: the prohibition of slavery and the authorization of township organization wherever county electorates might vote in favor of it. Previously under southern influence the county had been the prevailing unit of local government. After 1848 the northern counties lost no time in adopting township organization, and eventually the central counties did likewise, but a number under strong southern influence have retained the county as the primary unit to the present day. For decades bitter political struggles were carried on in many counties over this issue of local government.

Illinois took an important role in the long controversy over slavery. Sentiment was sharply divided on the issue. One incident was the murder of the abolitionist ELIJAH P. LOVEJOY by a proslavery mob at Alton in 1837. In 1858 occurred the Lincoln-Douglas debates; although Abraham Lincoln was defeated in his campaign for the senatorship he did clarify certain issues and he raised himself to national prominence so that two years later he was nominated for the presidency by the Republican party. During the Civil War, Illinois was an important source of men and supplies for the North; it sent 214,133 men into the Union armies, including Gen. U. S. Grant. Yet in some of the southern and central counties there was much sentiment for the Confederacy.

**The Industrial State.** Immediately after the Civil War the state began a rapid industrial development. Chicago, favored by a rich agricultural hinterland and by unusual transportation facilities, became the leading stock and grain market of the country; its growth was slowed very little by the terrible fire of Oct. 9-10, 1871 (see DISASTER, Fires and Explosions). In 1869-70 Illinois adopted its third state constitution, which is still in effect. The most important political controversy of the 1870's centered around the Granger movement, which was a campaign led by the farmers for the regulation of railroads and other public corporations and directed also against industrial trusts in general. (See GRANGE, THE.) The state experienced several periods of labor trouble. Riots in July, 1877, during a railroad strike led to the calling out of the militia and Federal troops. The labor troubles of 1886 culminated in the Haymarket riot, when seven Chicago police were killed. Eight men were tried and convicted; four were executed, and another died, presumably a suicide, in prison; the three survivors, serving prison terms, were pardoned by Gov. John P. Altgeld in 1893. A railroad strike occurred in 1894; again there was much violence and destruction of property until President Cleveland sent in Federal troops. A memorable coal strike occurred in central Illinois in the same year. Yet the state made great industrial and cultural progress in spite of such conflict. An event of great significance in American history was the World's Columbian Exposition held at Chicago in 1893.

During the 1890's the Populist party enjoyed considerable support in Illinois. Yet in 1896 the Democratic ticket, headed by William J. Bryan for president and John P. Altgeld for governor, was defeated even though it enjoyed strong Populist support. Thereafter not until 1912 did the state elect another Democratic governor; in that year the split in the Republican ranks gave the victory to their opponents for the second time since 1860. During World War I more than 200,000 Illinois men served in the armed forces. In 1918 Governor Frank O. Lowden made an important governmental reform when he secured the adoption of a bill consolidating 100 departments and boards into a small number of executive departments. In 1922 a constitutional convention drafted a proposed new constitution, but the voters rejected it on the ground that it gave too much power to the Supreme Court and insufficient authority to the city of Chicago.

In 1924, with the popular approval of a \$100,000,000 bond issue, Illinois began the construction of an elaborate highway system. The dissatisfaction caused by the economic depression led to a Democratic landslide in 1932; Henry Horner became the third governor of his party since the Civil War, and gained reelection in 1936. Oil was discovered in the central and southern portions of the state in 1939. Although Roosevelt carried Illinois in 1940 and 1944, the Republicans under Dwight Green gained control of the state government. During World War II, more than 900,000 Illinois men and women served in the armed services; there were over 27,000 casualties. Work on atomic energy, pioneered at the University of Chicago, was carried on after the war at ARGONNE NATIONAL LABORATORY. In 1948, Adlai Stevenson, Democrat, defeated Green for the governorship. In 1950 the voters approved the Gateway Amendment, providing for easier constitutional amendment.

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**ILLINOIS AND MICHIGAN CANAL**, completed in 1848 between Chicago and La Salle on the Illinois River. In 1673 LOUIS JOLLIET and Father JACQUES MARQUETTE, wearied by the portage from the Des Plaines River to the Chicago River, saw the value of such a CANAL. In 1816 President Madison approved the project, and a treaty was made with the Potawatomi Indians for the acquisition of a strip of land 20 miles wide along the Des Plaines and Illinois valleys. The state of Illinois later undertook the project, the first spadeful of dirt being turned on July 7, 1836. The panic of 1837 hampered construction; in 1842 work was stopped because the state was bankrupt. The project was soon resumed and completed; the first freight boat from New Orleans arrived in Chicago on April 23, 1848. From Chicago to the head of river navigation at La Salle the distance was 96 miles; the canal was 60 feet wide with 13 locks and with 90 feet of land on each side of the ditch for the right of way. Passengers could travel through the canal in about 24 hours for a fare of \$4. Chicago immediately boomed in commercial importance. Within a few years, however, the usefulness of



the "Old Ditch" was lessened because of the construction of the Illinois Central and other railroads. Even so, tolls on the canal exceeded expenses until 1879. The canal was continued in use until 1930, being replaced by the new and deeper ILLINOIS WATERWAY. Among the artificial waterways of the United States the "Old Ditch" was exceeded in importance only by the ERIE CANAL. The 96-mile right-of-way has been developed by the state for recreational purposes and the old towpaths have been converted into pleasure drives. In 1947 Congress voted to turn the canal right-of-way over to the state for the construction of a highway.

F. M.

BIBLIOG.—J. W. Putnam, *The Illinois and Michigan Canal* (1918).

**ILLINOIS CENTRAL RAILROAD.** Serving 14 states of the Midwest and South with over 6,900 miles of track, the Illinois Central is the nation's chief north-south rail artery. The Illinois Central Railroad Company, parent of the present system, was chartered in 1851 by the General Assembly of Illinois. The charter conveyed to the company 2,500,000 acres of public lands granted to the state by Congress the year before, and the I.C. thus became the first land-grant railroad.

The Act of Congress stipulated that a rail line should be constructed from the junction of the Ohio and Mississippi rivers to the southern terminus of the Illinois and Michigan Canal, built in 1848 and connecting the Chicago and Illinois rivers. Branches were to run to Chicago and to a point opposite Dubuque, Iowa. This route, completed in 1856, was designed to open the interior of Illinois to settlement, and to form a year-round "portage" between Chicago, the lake port, and the river port through which cargo could be taken to the Gulf of Mexico over the century-old Mississippi River trade lines.

Citizens of Mobile on the Gulf at about the same time launched a rail line intended to extend north to meet the Illinois Central. To prevent Mobile's bypassing it as the chief Gulf port, New Orleans citizens began the New Orleans, Jackson and Great Northern Railroad, which reached Jackson, Tenn., by 1861. The Civil War halted further construction, but the two lines were joined by 1873, and the 912-mile route from Chicago to New Orleans still forms the backbone of the I.C.

The road serves states embracing a third of the nation's population. It traverses a region of varied agricultural, mineral, lumbering, and manufacturing production, extending from the 30th to the 43rd parallel. The I.C. has more than 500 connections with more than 150 railroads. States it serves produce 85 per cent of the nation's corn, 80 per cent of the cotton, 76 per cent of the wheat, 74 per cent of the cattle, 81 per cent of the hogs. The Illinois Central is one of the nation's chief coal-hauling roads, and other important minerals carried include iron ore, fluor spar, gypsum, salt, sulfur, oil, asphalt, limestone, sand and gravel. See RAILROAD.

J. COLVIN

**ILLINOIS COLLEGE.** See COLLEGES.

**ILLINOIS INDIANS,** a confederation of North American Tribes belonging to the ALGONQUIN family whose name, Illiniwek (men), in its French form survives in the state and river of Illinois. Although now extinct the Illinois were once a great people. They were first described by Father JACQUES MARQUETTE, who passed through the Illinois country in 1673. The Illinois confederacy consisted of six tribes—the Kaskaskia, Cahokia, Michigamea, Moingwena, Peoria, and Tamoroea. The Miami were a closely related tribe. Estimates of the number in the confederated tribes ranged from 6,000 to 9,000. Early French explorers spoke of the great village of the Illinois, located on the north side of the Illinois River, nearly midway between the modern cities of LaSalle and Ottawa; this village was the home of the Kaskaskia but was a congregating point for the other tribes as well. The Peoria usually lived at Pimiteoui

(Lake Peoria); in 1679–80 La Salle found the whole confederacy here in winter quarters. The Illinois lived by fishing and hunting and by the crude cultivation carried on by the squaws; corn, beans, melons, and squash were raised. The men were well built physically but by 1680 they had already lost most of their prowess in war. Polygamy was practiced since the women exceeded the men perhaps four to one. The Illinois were friendly but were also somewhat treacherous. French missionaries gained ready converts, although one priest suffered martyrdom. In the summer of 1680, just a few months after the visit of La Salle, the Iroquois (who had secured firearms from the Dutch in New York) destroyed the Illinois villages. A few years later La Salle built a fort on the Rock (Starved Rock) and gathered around his outpost the Illinois and other tribes for mutual protection from the Iroquois. After the death of La Salle his lieutenant Henri "Iron Hand" Tonti moved the fort and Indian village to Pimiteoui. After the abandonment of this post about 1699 the Illinois tribes (except the Peoria) moved to the Mississippi Valley near the mouth of the Kaskaskia River, where a small French settlement soon appeared. Thereafter the Illinois degenerated rapidly; by 1800 there were only about 150 demoralized survivors. In 1833 they sold their Illinois holdings and removed to the west. A few descendants, with much admixture of white blood, are now found on reservations in Oklahoma among other tribes. See NEW FRANCE; CAHOKIA; KASKASKIA; ILLINOIS, History; INDIANS, AMERICAN.

F. M.

BIBLIOG.—C. W. Alvord, *The Illinois Country, 1673–1818* (1918); *De Gannes Memoir*, published by T. C. Pease and R. C. Werner, eds., *The French Foundations, 1680–1693* (1934).

**ILLINOIS INSTITUTE OF TECHNOLOGY,** a technical school in Chicago, Illinois, was formed in 1940 by the consolidation of Armour Institute of Technology and Lewis Institute. Armour Institute of Technology was founded in 1892 by PHILIP DANFORTH ARMOUR. Lewis Institute was founded three years later through funds provided by the estate of Allen C. Lewis. There are 14 degree-granting departments: architecture, chemical engineering, chemistry, civil engineering, electrical engineering, fire protection and safety engineering, food engineering, industrial engineering, mathematics, mechanical engineering, metallurgical engineering, physics, technical drawing, and design. (The Institute of Design, which had been founded in Chicago by László Moholy-Nagy in 1939, became a degree-granting department of the Illinois Institute of Technology in 1949.) In its Liberal Studies division, the Institute offers degrees in the following departments: biology; business and economics; language, literature, and philosophy; home economics; political and social science; psychology and education.

The Armour Research Foundation of Illinois Institute of Technology, founded September, 1936, has already gained recognition as one of the world's foremost scientific research institutions. Operated on a not-for-profit basis, the Foundation conducts an extensive research and experimental engineering service for industry. The Armour Magnetic Wire Sound Recorder and Reproducer is one of the projects developed through the Institute's Armour Research Foundation. The Institute of Gas Technology, founded at Illinois Institute of Technology in June, 1941, is a research and personnel-training organization supported through contributions from the gas industry.

R. W.

**ILLINOIS RIVER,** flowing through Illinois in a southwesterly direction for its entire course of about 272 miles, is formed by the junction of the Kankakee and Des Plaines rivers, and joins the Mississippi River at Grafton. The Illinois, navigable its entire length for commercial traffic, forms the connecting waterway between the Mississippi River and the Great Lakes. Boats use a series of five locks and dams in the river and may continue via the Des Plaines

## Illinois State Normal

River and the Chicago Sanitary and Ship Canal to Lake Michigan. The river and canal system is called the ILLINOIS WATERWAY. Traffic on the stream is interrupted during the cold winter months. The water throughout most of the length of the river is impure, principally because of Chicago sewage. See CANAL.

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### ILLINOIS STATE NORMAL UNIVERSITY.

See COLLEGES.

**ILLINOIS, UNIVERSITY OF.** Incorporated in 1867, the University of Illinois with campuses in Champaign-Urbana and Chicago, Illinois, is one of the largest state supported universities in the United States. Instruction began in 1868 as the "Illinois Industrial University." In 1885 the present name was adopted.

Within fifty years the university grew to large size. From the beginning the curriculum included the arts and sciences, agriculture, engineering, and military science. Graduate study began in 1880 with a formal graduate school opened in 1892. Other expansion included pharmacy (1896), law (1897), library science (1897), medicine (1897), dentistry (1901), and education (1905). A school or department of music has been in existence since 1895, although music is no longer organized as a separate unit of the university. The Agricultural Experiment Station dates from 1888. An Engineering Experiment Station dates from 1903.

The present organization of the university consists of the College of Liberal Arts and Sciences, colleges of agriculture, veterinary medicine, engineering, law, commerce and business administration, and fine and applied arts. There are a Graduate School and other schools of library science, journalism, education, and physical education. The Chicago professional schools comprise the three colleges of medicine, dentistry, and pharmacy.

The university operates a press and a radio station. An Institute of Aeronautics is located in Urbana near where the university also operates an airport. The activities of the university are extended to the citizens of the state through a university extension division, a small homes council, and the summer session, which offers special courses for school teachers. Large enrollments due to the influx of students under the G. I. BILL OF RIGHTS were met by opening additional facilities for undergraduate instruction in Chicago and Galesburg. The division of Special Services for War Veterans assisted in this program. The university is a member of the Association of American Universities.

ROBERT MARSH

**ILLINOIS WATERWAY**, a continuous, navigable, deep waterway linking Lake Michigan to the Mississippi River by canals and canalized rivers. The waterway, completed in 1933, utilizes the Chicago, Des Plaines, Kankakee, and Illinois rivers, the Sanitary and Ship Canal, and eight locks. The canal is 327 miles long and each lock has usable dimensions of 110 feet wide by 600 feet long. Principal cities along the route are Chicago, Joliet, Ottawa, La Salle, Peoria, Pekin, and Beardstown; the route ends at Grafton, Illinois. As early as 1673, Louis Jolliet recognized the need for a canal that would connect the Chicago River to the Des Plaines and provide a continuous waterway to the Mississippi. La Salle, considering the flow characteristics of the Des Plaines and Kankakee rivers, pointed out that the canal would have to extend from the Chicago River to the Illinois River. By 1848 such a canal had been dredged. The Illinois Waterway begins at the mouth of the Chicago River, where since 1848 locks have reversed the flow of water. The route follows the south fork of the Chicago River; at 26th street in Chicago there is a concentration of slips and docks. The route leaves the river just west of this point and enters the Sanitary and Ship Canal (Chicago Drainage Canal) which is 20 feet deep and from 160 to 300 feet



U.S. CORPS OF ENGINEERS

**Illinois Waterway links Lake Michigan with the Mississippi River.** This is highway bridge at Ottawa

wide. It is paralleled by the abandoned Illinois and Michigan Canal, and by the Des Plaines River. About seven miles above Lockport the Calumet Sag Channel enters the waterway. Sag Channel leads directly to the industrialized Calumet district, south of Chicago, and via the Calumet River enters Lake Michigan. At the Lockport dam and lock the Sanitary and Ship Canal ends. The lock controls the amount of water withdrawn from Lake Michigan and lifts vessels 41 feet to the next level. Downstream from Lockport to Grafton the low water channel is about 300 feet wide and 9 feet deep. The Des Plaines and Kankakee rivers join 18 miles below Lockport to form the Illinois River. Eight miles below the junction is Brandon Road Lock and Dam, a lift of 31 feet, and a turning basin. The waterway follows the course of the Illinois River for 273 miles until it joins the Mississippi. Between the mouth of the Des Plaines and the Great Bend of the Illinois, the waterway flows in a deep, broad channel between sandstone bluffs. Once the river turns south it flows in a broad valley from two to six miles wide. There are lakes and sloughs on the valley floor that are navigable for vessels of shallow draught; the main channel is in the middle of the stream. At Peoria there is a river and rail terminal for the transfer of cargo. The towns downstream are historic landing points and still move some of their produce by water. Fueling, mooring, and repair stations are available in all of the larger cities. Along the route are several state parks and forest preserves.

The Illinois Waterway is Federally owned and the main traffic is the Federal Barge Line, a fleet of barges and towboats operating between Chicago, Minneapolis, St. Louis, Kansas City, and New Orleans. Between January, 1942, and October, 1945, 1,136 newly constructed war vessels were moved out to sea by way of the canal. Large vessels moved down the Illinois Waterway under tow; ships with deep draught were placed in pontoon drydocks for towing. Small vessels moved under their own power.

E. K. A.

**ILLINOIS WESLEYAN UNIVERSITY.** See COLLEGES.

**ILLITERACY.** See LITERACY AND ILLITERACY; EVENING SCHOOLS.

**ILLUMINATED MANUSCRIPTS.** The practice of decorating or illustrating a written text with ornaments or pictures executed in color and gold (sometimes silver was also used), all the work done by hand, is known as *illumination*. The old word, borrowed from the French, was *enlumine*, and it is often used by many of the early writers, among them Chaucer. This type of illustration was very popular from the earliest times. The ancient Egyptian Book of the Dead, dating as far back as 1500 B.C. is evidence of the Egyptian ability for combining text and pictorial representation and it is known that the illustrated book was



very popular with the Romans. However, these early examples are of a representational art which had little to do with decoration and embellishment and very little of this kind of work has been preserved. See BOOK OF THE DEAD.

Hand illumination of texts played an important part in Byzantine art and the somber expressions of Byzantine splendor exerted a great influence on the artistic life of western Europe, notably in Italy. Illumination had reached full development in the Byzantine examples of the ninth and tenth centuries. Two of the best proofs of this are to be found in a copy of the sermons of Gregory Nazianzen (about 880) and a 10th century psalter, both of them in the Bibliothèque Nationale in Paris. These show understanding and skill in the drawing of heads and figures. The Byzantine style presents heavily gilded backgrounds which give great brilliance to the forms and scenes painted on them. There was no consciousness of landscape and the depths of infinity are shown merely as a blinding sheet of gold. Initial letters stand out in gold and colors but austerity dominates them and there is little suggestion of the flowering and joyous decoration to be met later in the works of the medieval scribes. But their rich oriental quality lent flavor to later western art. An art such as this which was so strictly confined to ecclesiastical viewpoint and did not extend to simple life or earthly pleasures could not have a long life. After the great work of the ninth and tenth centuries, a period of decadence set in. There was much repetition and copying of earlier examples, but in spite of all this, Byzantine illumination had contributed its strong influence which recurs again and again, like an echo, in the history of hand-illuminated texts. See BYZANTINE ART.

**Scribes at Work.** Before a description of the various European styles, it might be well to give some account of how the scribes worked and under what conditions the manuscripts were produced. Of course all manuscripts were copied from texts and the scribe was merely a skilled copyist. It was understood that he was to reproduce the text as it was given to him and make no alterations, even when he recognized errors. All of this work was done in the monasteries in a room set aside for the purpose which was called a *scriptorium*. (See MANUSCRIPT for illustration of scriptorium.) Each scribe sat near a window and all work was done by daylight; no artificial light was

ever used. Perhaps this accounts in part for the exquisite finish, the sense of pure, clear and serene color in every well-written page or beautifully executed miniature. Parchment, pens, etc., were issued by an officer of the scriptorium known as an *armarius*. Talking among the scribes was not permitted; communications were made by signs. A day's work took up about six hours. Parchment was distributed in sections of folded sheets and directions were given as to the style of writing and its size. The scribe then set to work, after ruling in the margins, the parchment being pinned down with awls to hold it in place. When the section was finished it was passed on to a proofreader who made strict comparison of the new copy with the original. At this stage the manuscript was merely the unadorned text, there were as yet no initials, headings or miniatures. The ornate initials (many of them as elaborate as miniatures) were put in by the *rubricator* who also had the work of adding titles and notes assigned to him. The task of illumination came last and the work was given to the illuminator who added the illustrations. The book was now ready for binding and this, also, was done by a separate craftsman. Thus it is difficult to answer the question, so often asked, how long did it take to complete a manuscript, for the work was not done by a single person, it was the result of the co-operation of many, working together on an early "assembly line" type of job. But it was not "jobmindedness" which motivated these men—there is care and devotion in every stroke and the dedication of their lives to a craftsmanship raised to the power of true artistic expression.

**Celtic Style.** In Ireland, as far back as the seventh century, the manuscript art was highly developed. Here ornamentation developed free of foreign influence and a strong and characteristic native style came into being. The borders of pages, initials, even entire pages are filled with the most fanciful and beautiful creations of the imagination. The feeling is always for design and not pictorial representation. Yet the faculty of observation amazes us and these decorations tell us as much as any narrative type of picture could. There is hardly anything of the common life of his day that the Irish artist did not utilize; animals, ribbons, ropes, vines, flowers are all wound and woven into these intricate patterns to produce initial letters and borders. It is all done with an infinite, painstaking care for workmanship and embellishment. The painting was done with thick colors, producing an enameled effect, but gold was never used. There have been many attempts to trace the sources of these zigzag and knotted designs and it may be true that much was due to the jewelry and other ornaments which had been imported from other lands, but if so, the treatment is so Celtic in character that these decorations in books have become regarded as peculiarly national and original. The most famous of the Irish manuscripts—and the greatest—is the *Book of Kells*, a copy of the Gospels which was made toward the end of the seventh century, and which is now at Trinity College, Dublin. In Scotland variations of the early Celtic style appeared combined with Byzantine influences in the use of gold and in the drawing of figures. The famous *Durham Book* or *Lindisfarne Gospels* in the British Museum is the best example of the early work of the Scotch monks. It is celebrated for its writing done in the Celtic manner, for its ornamentation and for its miniatures copied after Byzantine models. These early Celtic and Scotch manuscripts have exerted a great influence on English book illustrators in modern times.

The reign of Charlemagne which began in 800 marked the beginning of cultural renaissance and under his patronage many beautiful books were produced. Here was a bringing together of the Celtic style of ornament with the classical use of architectural forms. The aim of these books was magnificence and sometimes this is carried so far that it becomes oppressive and dull. But this should not condemn the



PARADE-BEKKER GALLERIES

French illuminated manuscript of 15th century

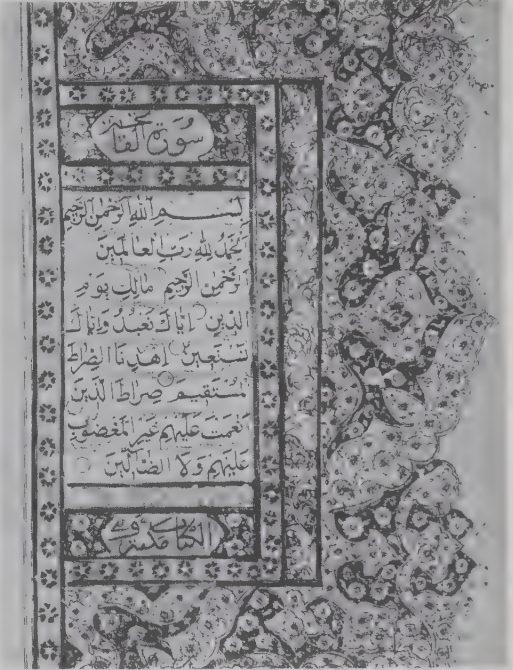
great works of this time for the best designs are animated with lively drawing and an elaborate concentration on apparently insignificant details which are as full of life and the ineffable freshness of old times as any work ever produced. The Carolingian school came to its height during the reign of Charlemagne's successors, especially during the time of Charles the Bald. In the 11th century its glory had gone and the usual decadent copying of older and more virile models had set in.

**Italian Manuscripts.** In Italy there was a strong Byzantine influence which extended as far as the paintings of Giotto and Cimabue and, of course, this is felt in the early Italian manuscript books. This was, however, coupled with the ornamental manner of scrolls, interlaced figures, and vines of the school of Lombardy. The great Italian fresco painters are all reflected in the manuscript miniatures, in fact, many of these are portable versions to be enjoyed in moments of private meditations, of what had affected the owner when he gazed at the walls of the churches with their powerful and moving spiritual representations. But illumination in Italy did not confine itself to religious books alone. It spread to the pages of treatises on law, to manuscripts of music, to public addresses and declarations, thereby becoming freer in its treatment and choice of subjects and it is here that the line drawing makes its first appearance, beautifully defined and delicately colored.

**Climax.** All these influences brought the art of illumination to great possibilities by the end of the 13th century. The borders of pages which had been little more than frames were now divided into compartments, built up architecturally, and having their own special artistic function to perform. A great harmoniousness of text and border was achieved and this, with its beauty and excellence, seems to have been conducive to better efforts on the part of the miniaturists so that they, too, would not be outdone. When the 15th century began a larger field of expression opened up before the miniature painter. The dazzling gold background of the Byzantine style had been pierced and removed. The artist could at last look into space, no longer shut off by a wall, but stretching as far as the eye could see and filled with an infinite number of the wonders of life. It was in this time that the painting of miniatures in manuscripts spread from the monasteries and became a trade in the cities and towns where miniaturists won fame under their own names. In France, during the latter half of the century, the great JEAN FOUQUET and his sons were at work in Tours. In Flanders there were MEMLING and Gerard of Bruges. They were all essentially picture painters and it becomes evident in looking at the work of this period, that the manuscript volume has prepared the way for the modern illustrated book. Although Germany and Holland did not produce a great deal of notable work, even in the 15th century, Italy carried on the development she had made in the 14th. The ornamental borders of the pages were not neglected and renaissance art contributed many innovations such as brightening the backgrounds of leaves and vines with brilliant drops of gold, peopling them with cupids, fauns, decorating them with vases, jewels, candlesticks, etc. There is a beautiful copy of *Plutarch's Lives* in the British Museum and one of *Aristotle's Ethics* which show us the best representations of this time and illustrate how the illuminated manuscript had spread to the field of secular literature and was no longer confined to religious usage. In Spain, after primitive attempts, the art was left to artists imported from France, Flanders, and Italy.

Although illumination was still practiced as late as the 16th century, it had by that time become a dying art. In the early printed books spaces were left for initials and decorations to be added by hand, and although these were sometimes successful, they were merely the survival of an earlier and perhaps

happier age which was gone forever. The illuminations are unusually permanent, for on the parchment pages, color has seemed to grow in brightness with age. However, the methods of writing and painting which are lost and impossible to imitate in modern times



ORIENTAL INSTITUTE OF CHICAGO

Page of Illuminated Koran, illustrated in Persian style, dates to 13th century

seem to have been carried away by the years in which they were practiced, like a secret. In the Orient, too, this art had known its greatness. Among the Persians and Arabians examples were produced which apart from any influence exerted by western culture were just as full of beauty, exquisite execution and feeling.

HUGH EDWARDS

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**ILLUMINATI**, the name assumed by, or given to, certain groups of mystics who have claimed that they were able to receive spiritual illumination through the cultivation of an inner light. Some of the sects which may be included under the term are the *Alumbrados*, which originated in Spain about 1520 and were finally crushed by the Inquisition; the *Guérinets* in France, who were organized in 1623 under the leadership of Pierre Guérin and suppressed in 1635; another sect in the south of France which began about 1722 and ended with the Revolution; and an association of mystics in Belgium during the latter half of the 18th century.

The name is more particularly given to the *Order of the Illuminati*, which was founded by Adam Weishaupt (1748-1830) at Ingolstadt, Germany (1776). The movement became very popular in some parts of Germany, and at one time numbered more than 2,000 adherents. The followers of Weishaupt were known as *Perfectibilists*. The movement was based on a Masonic plan of organization and had a close relationship with the Masonic order. The order appealed



especially to the German rationalists of the period. The doctrine underlying the Perfectibilists was a form of DEISM which rejected dogmas and ceremonials. It was regarded favorably by Goethe, Herder, and other outstanding men of the time, but the Roman Catholic church repudiated the movement, and in 1785 an edict of the Bavarian government dissolved the order.

Members of the Rosicrucian Order, which was founded in the 16th century, have called themselves Illuminati, and individuals who have claimed to be motivated by inner illumination, such as JOAN OF ARC and EMANUEL SWEDENBORG, might be considered Illuminati, even though they do not belong to any particular sect or movement. See ROSICRUCIANISM.

**ILLUMINATING GAS.** See GAS ILLUMINATION; GAS MANUFACTURE.

## ILLUMINATION

### Good Light for Good Sight

*Since 1900 science has taken great steps in suiting artificial light to man's indoor use, health, and comfort*

**ILLUMINATION.** Adequate and appropriate illumination is the outside agency which enables quick, accurate and comfortable seeing by normal eyes. Light and vision are partners in the seeing process; without one, the other is useless. Good illumination is light of sufficient quantity, comfortable as regards lighting quality and of a pleasant color proper for the visual tasks involved. As such, lighting is an indispensable aid to physical well-being, human productiveness, merchandising efforts and artistic value.

Throughout the ages, man has tried to provide artificial illumination and thus extend his scope of activity beyond the hours of daylight. The flame was the only light source for millions of years, and while progress was shown in the successive development of wax candles, oil lamps, tallow candles and gas lamps, there was little significant gain in the efficiency of light production until electric lamps were produced in the 19th century. The invention of the electric arc and the incandescent lamp began an era of light-source developments which is now evidenced in the complete line of filament and electric discharge lamps for a multitude of lighting requirements. (See LAMP, ELECTRIC.) Free from the inherent disadvantages and limitations of the flame source, these comparatively recent developments have enabled civilization to emerge from the infinite past of "mere light to dispel darkness" to an era requiring abundant artificial light for health, welfare and comfort.

Coupled with improvements in light sources have been extensive researches in the realm of seeing and the fundamental relationships of light and sight. Because the human eye evolved for centuries under conditions of natural lighting, many principles revealed by studies of daylight illumination have been applied to artificial lighting practice. Investigations likewise have shown the need for more abundant light of improved quality for the prolonged and continuous-concentration visual tasks so characteristic of present indoor work. These scientific data form a basis for the specification of light and lighting.

Except for earlier isolated physical measurements, chiefly on the intensity of light sources, this entire field of research and practice is new, practically all the work having been done since 1900. As a branch of professional activity, its recognition may be dated from the founding of the Illuminating Engineering Society in 1906. More than most other engineering branches, however, in addition to physical sciences it touches also on the domains of psychology, physiology, and aesthetics.

**Artificial Illumination.** Artificial illumination may be generally classified as (1) lighting for seeing, (2) lighting for selling and (3) lighting for production. Some typical examples of the first group are office, school and drafting room lighting systems; lighting for selling includes those illumination systems allied with display, decoration and entertainment such as is found in stores, restaurants, expositions, theaters and similar interiors. Lighting for production embraces the broad realms of industrial plant lighting. In most illumination applications (aside from the latter group), the lighting system must not only be functional but decoratively appropriate. Fixtures are normally available in a variety of styles: some entirely functional, others largely decorative, and more at points between the two extremes cited. While the appearance of the lighted room is an important factor in the actual selection of fixtures, considerations of direct glare, reflected glare, suitability of light distribution and ease of maintenance would be dominant in many cases. The major purpose of a lighting system is defeated if seeing requirements are not fully met, and no amount of decorative art can make up for this deficiency. On the other hand, it is entirely possible to secure artistic appearance without sacrificing usefulness and without introducing glare or other deterrents to quick and easy seeing.

The evolution of fixtures shows a gradual trend toward the fulfillment of well-known lighting quality essentials: the minimization of glare (both direct and reflected) and shadows, and the provision of a nearly uniform level of illumination adequate for the visual task at hand. Great strides have been made possible by the development and commercial introduction of fluorescent lamps. These tubular sources have relatively low brightness, are more efficient than incandescent lamps, and produce diffused light. Such lamps are being widely employed because they make comfortable high-level illumination economically possible.

While daylight lighting conditions are considered ideal, daylight itself cannot alone do the whole illumination job. For example, even though many factories have large window areas, there are several reasons why the natural lighting is not adequate in itself: high percentage of cloudy and partly cloudy days, extreme variation in daytime illumination values throughout the day, failure to clean the windows frequently, and rapid decrease of natural illumination in the direction away from the windows. Properly designed artificial lighting systems can, on the other hand, provide good seeing conditions at all times and at any position in the given interior. Some fundamental concepts of lighting practice which can be employed in any general illumination system follow:

**Minimize Glare.** Glare is commonly defined as "light out of place." More specifically it is the term applied to a lighting condition which causes eyestrain or discomfort. Glare is not only the principal cause of uncomfortable lighting, but because it also reduces visibility, the effectiveness of the glare-free light is actually lowered. This loss in visibility results because the iris of the eye adapts itself to the prominent brightness (glare) and is unable to open enough to distinguish details most effectively. There are two types of glare, direct and reflected; the former is caused among other things by unshaded or insufficiently shaded light sources within the field of vision and by high contrasts between a bright light source and its dark background or adjacent surfaces. Reflected glare results when images of annoying brightness are directed toward the eyes by polished or specular surfaces and is often more objectionable than direct glare because reflected glare is generally from a direction below the horizontal (a zone in which the eye has no natural protection). In addition, the specular characteristic of work producing the reflected images cannot often be changed. Common causes of reflected glare: (1) use of fixtures which do not diffuse the light sufficiently and present high brightnesses in the di-

rection of the "works-eye" view, and (2) the incorrect placement of supplementary lighting units which permits bright images of a light source to reach the eyes.

Because eyes are naturally attracted to high brightnesses and require some time to readapt themselves to levels of the work task, both direct and reflected glare are responsible for reduced accomplishment. Natural daylight is also a common producer of glare when the task is between workers' eyes and the windows. Wherever possible the working surface should be shifted to put the natural light on the work rather than into the eyes, or if that is impractical, shade the windows.

**Provide Diffuse and Uniform Illumination.** Ordinary lamps should be enclosed in reflectors or globes where they are within the normal field of view (or "direct glare" zone) to reduce the intensity of light directed toward the eyes. In addition, shadows are more soft and less pronounced when diffusing units, and units having a wide distribution of light, are employed since with such systems the object is illuminated from many sources and directions. While some shadow patterns and directional effects are desirable in most general lighting installations to accentuate the depth and form of solid objects, sharp and harsh shadows should be avoided. In those cases where clearly defined shadows without excessive contrast are an obvious aid to seeing, they are best secured by combining supplementary directional sources with an adequate level of general illumination. Typical of these are engraving on polished surfaces, textile inspection, and scribed layout work.

Near uniformity of illumination throughout the room eliminates dark corners and spottiness and makes the whole area equally suitable for work, display or for whatever purpose the room is employed. In addition, uniform lighting conserves visual effort, for when there are alternate light and dark areas in strong contrast the eyes must adapt and readapt to different brightness levels, with attendant loss of the adaptation time necessary. For these reasons, specialized local lighting should be accompanied by general illumination of a level sufficient to reduce the brightness ratios within the normal field of view to not more than 10:1 and preferably not over 5:1.

Uniform illumination is secured by the proper relation of fixture spacing to mounting height for the type of luminaire distribution involved. There are four general types of luminaire distribution: indirect, semi-indirect, semi-direct and direct, ranging as the designations imply from units throwing all the light upward to provide illumination on the work place "indirectly" by reflections from ceiling and walls to fixtures directing all their output downward. In indirect systems the ceiling becomes in effect the light source and diffuse reflections from matte ceiling surfaces result in soft shadows and glare-free lighting up to around 50 foot-candles (see later explanation), above which the ceiling brightness often is considered uncomfortably high. Semi-indirect fixtures are defined as those emitting some light downward but over half the luminaire output upward. In semi-direct systems the predominant light on the customary horizontal working surfaces comes directly from the fixtures employed, but the upward component produces a considerable contribution by ceiling reflection. A direct-lighting unit is one in which the light is directed essentially downward. Luminaires designed to send light both upward and downward but having low brightness in the direct glare zone are commonly spoken of as "direct-indirect" units.

In general, direct and semi-direct lighting units should be no farther apart than their mounting height above the floor to secure good uniformity of illumination. Luminaires of the indirect type can be spaced by an amount at least equal to the ceiling height, and in some cases the spacing can slightly exceed the ceiling height.

**Provide an Adequate Level of Illumination.** Researches in the Science of Seeing have developed a definite relationship between the level of illumination and its benefits. These relationships indicate the value of lighting levels often considerably in excess of those found in actual practice. The latter have advanced slowly from time to time as the overall cost of light decreased and more satisfactory reflecting equipment became available. New developments in light sources, particularly those involving improvements in the efficiency of light production and a decrease in heat and energy radiated, have affected the illumination levels found in practice. Both heat and radiant energy per unit of illumination are much less for fluorescent lamps as compared with incandescent sources, so higher levels can be obtained with considerably more comfort than formerly. This has important economic aspects in air-conditioned interiors.

While the eyes are remarkably flexible in their ability to see under extremely low levels of illumination, optimum visual comfort and efficiency is attained only by providing sufficient light of the proper quality to make the work details instantly and easily visible. Not all tasks are equally visible under the same amount of light. For example, the headline of a newspaper is much more easily seen than the relatively small type in the body of the paper because the distinguishing details in the letters of the former are larger. Factors in addition to size which influence visibility are contrast with the background, the brightness of the object, and the time available for seeing. Three of these factors (size, contrast and time) are usually more or less uncontrollable in any specific instance; brightness, however, is determined to a large measure by the lighting which can be controlled, and its desirable level is dictated largely by the other three factors. The brightness of a diffuse surface is equal to the product of the illumination level and the reflection factor of the surface.

The common unit of illumination is the *foot-candle*; the intensity of illumination of a surface one foot distant from a source of one candle power and perpendicular to its rays. The illumination varies directly with the intensity of the source and inversely as the square of the distance, i.e., a source of 100 candles 5 feet away gives an illumination of 4 foot-candles. (See PHOTOMETRY.) If the light does not strike the surface perpendicularly, the illumination is reduced. Thus, if the lighted plane is horizontal, and not normal to the light path, the total light formerly received would be spread over a larger area. This area is secant A times as great as the unit plane normal to the light rays, or the amount of light received on a unit horizontal surface is

$$\frac{\text{candlepower}}{(\text{distance})^2} \times \cosine A.$$

This formula is used in "point-by-point" calculations and strictly speaking applies only when the light comes from a point source. However, it can be used to determine the direct illumination at definite locations without appreciable error when (1) the distance from the light source to the location in question is large compared with the size of the source and (2) there is little light reflected to that location by the surroundings. When the distance is 10 times the maximum dimension of the source, the inverse-square law can be employed with assurance.

Although foot-candle determinations by the point-by-point method are possible under the conditions mentioned, the system involves laborious calculations and is virtually limited to direct-lighting installations. The present system of illumination design in almost universal use is the Lumen Method, in which utilization factors or "coefficients of utilization" are calculated for any particular general-lighting luminaire and can then be applied with good accuracy to rooms of any dimension or shade of wall and ceiling finish.





**Keck Solar Home** invites full winter sunlight but its deep eaves guard it from summer's glaring heat

HEDRICH-BLESSING STUDIO



**Sunlight** completely penetrates the interior of the Keck solar home; this photograph was taken at noon

HEDRICH-BLESSING STUDIO



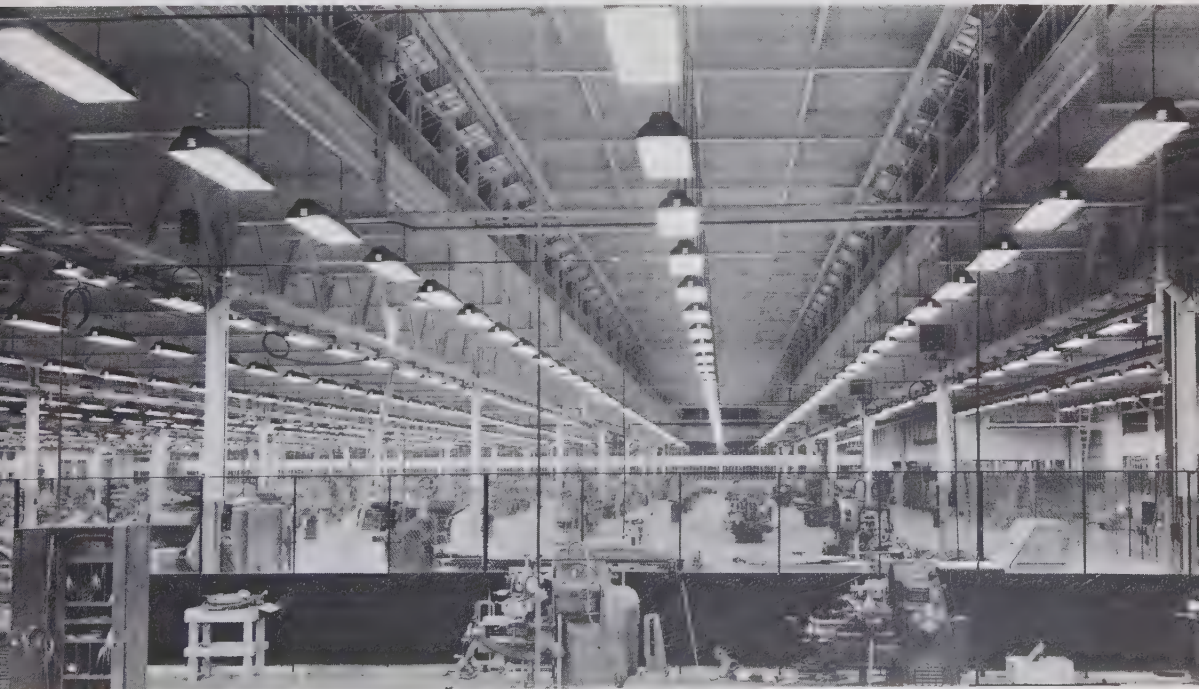
**Fluorescent Lighting** is an economical means of securing high-level illumination by diffused light

WAKEFIELD BRASS CO.



**Fluorescent Lighting** in drafting room eliminates shadows that drawing boards would ordinarily create

WESTINGHOUSE



**Fluorescent lighting** provides diffused illumination throughout large factory

GENERAL ELECTRIC CO.

The utilization factor is simply the percentage of the light generated by the lamps which eventually reaches the work plane; between are losses due to absorption in the luminaire itself and at the ceiling and side walls. Since large rooms, in general, use light more efficiently than small rooms (because there is less wall area to absorb light in relation to the floor space), the utilization factors are higher for large rooms. Likewise the factors are higher for interiors having light rather than dark wall and ceiling finishes. Light ceilings are essential to direct-lighting installations.

The unit of luminous flux (time rate of flow of light) is the lumen, equal to the amount of light through a unit solid angle from a uniform point source of one candle. In effect, the lumen expresses the quantity of light while the foot-candle indicates its density. The lumen can express the total output of any source, the output of a point source in any solid angle, the light received upon any area, or light absorbed, reflected or transmitted. The number of lumens required to illuminate a surface equals the average foot-candle level times the square foot of area. For example, if 30 foot-candles were desired in service for medium bench and machine work in an industrial area 40 by 60 feet, the lumens needed at the work plane would equal 30 times 2,400 or 72,000. If industrial-type fixtures mounted 12 feet high are to be employed, the utilization factor would be around 50 per cent, and 144,000 lumens would need to be generated. In addition, the fixtures will get dirty between periodic cleaning, the light output of the lamps will decrease gradually, and wall and ceiling surfaces will become darker. This combined depreciation or maintenance factor would be around 70 per cent, so the initial lumens produced by the installed lamps should equal 144,000/0.7 or around 206,000. This is approximately the output of 20 500-watt filament lamps used in fixtures on 10 by 12 foot centers, or 96 40-watt white fluorescent lamps in industrial reflectors individually spaced or in rows would also provide the 30 foot-candles desired.

CHARLES L. AMICK  
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**ILLUSION**, in psychology, is a false sense perception such as mistaking a stranger for a familiar person, one printed word for another, or the sound of another's name for one's own. It is common in normal life and may involve smell, taste, touch, and muscular sensations, as well as sight and hearing. Illusions occur also in nearly every type of mental disorder where they are related to HALLUCINATION and DELUSION. Hallucination is an error in perception in which a person believes that he perceives an external stimulus (e.g., an object or sound) when none exists; however, in illusion, an actual stimulus is misinterpreted. In DELIRIUM TREMENS the bedclothes may appear as terrifying animals; in SCHIZOPHRENIA the noise of a rustling curtain may be perceived as an accusing voice. This type of illusion is closely connected with delusion, a morbid false belief.

Illusions occur most readily in a state of emotional expectancy or when a person is preoccupied in thought. Hence we seem to see frightening shapes at night when we are already afraid or to misread a word when we are distracted by a second train of thought. Normal illusions may be detected by the person when the predisposing condition has passed; whereas those in mental disorder resist reason. Optical illusions depend on a wrong emphasis upon cues or on misapplied habits as in the tendency to overestimate vertical as compared with horizontal lines. See PSYCHOLOGY.

H. V. M.

## ILLUSTRATION

*Vivid, imaginative pictures accompanying the abstract printed word, illustrations help communicate written ideas*

**ILLUSTRATION** is the representation by pictures of ideas expressed in words. For its true origin one might go back beyond the invention of printing, even earlier than writing itself, to the time when man used drawings to express what he wished to communicate, but the modern meaning of the word is the aid given to thought and imagination by pictures accompanying a printed text. And, also, illustration serves as an adornment to the page: it can be evidence of highly developed taste or the absence of any taste at all. In the illuminated manuscript it grew to a flowering of rich, yet simple, beauty long before there were printed books in Europe. The old illuminators had a sense of conformity and balance which brought about on each page where illustrative miniatures appeared, the fusion of text, high pictorial art and the most perfect calligraphy. Perhaps no printed page has ever come near their work in unity and invention. It was about 1450 that illustrations from wood-block cuts began to appear and these were often printed in the pages of manuscripts to take the place of hand-painted illuminations. As there was little difference between cutting a picture and including words of text on the same block, whole books were printed from blocks on which both text and illustrations were cut. This was, of course, before the use of movable type cast in molds, and these books were known as *block books*. The best examples of them are the *Canticum Canticorum*, the *Ars Moriendi*, and the *Apocalypse of Saint John*. See WOODCUT; BLOCK BOOKS.

**Early Cast Type Books.** As the desire for knowledge prompted more men to read, so increased the need for books more easily produced for wide distribution. Then the book from cast type made its appearance. These early printed works were a bridge between the manuscript and the modern book, for in many of them spaces were left blank for large initials which were filled in by hand by scribes, thus bringing to an end a purely manual age and inaugurating the beginning of man's scientific communication of knowledge. Soon after 1460 the first typeset books with printed illustration were published. The earliest examples are to be found in seven volumes of a set of nine by Albrecht Pfister in Bamberg, Germany. As far back as these early times there was the desire for color, work and although these books and those which soon followed them were printed in black and white, the pictures from blocks cut in relief, they were frequently colored by hand. There is a direct honesty and brevity in the work of this period which many modern artists have consciously tried to equal. On the other hand are examples of the woodcut which are so elaborate in technique and style that they seem related to the ornate handwriting of those days.

It is in Germany during the last half of the 15th century that more illustrated books appeared than in any other country. Perhaps the finest of these are Breydenbach's *Perigrinationes in montem syon* (the account of a trip to the Holy Land) with woodcuts by Erhard Reuwich, among them the first large folding plates to appear in any book; the *Schatz-behalter*, illustrated by Michael Wolgemut, who also made the cuts for the famous *Nürnberg Chronicle*, printed by Koberger in 1493. In Italy, however, quantity gave way to quality and there is found a more sensitive effort to combine pictures with text so that a balance of the two is obtained without heaviness. The most famous—and perhaps the best—Italian book of this period is the *Hypnerotomachia Poliphili* of 1499. Although few of the early Italian books have illustrations colored by hand (a proof of the feeling for the purely graphic quality of the illus-



trations and their subservience to the printed page), it is believed that the earliest diagram printed in color is one in three colors in Ratdolt's *Sacrobosco* (1485). And, also in Italy, there was printing of illustrations from copperplates as well as woodcuts. In the edition of Dante, published in Florence in 1481, with illustrations engraved after the designs of BOTTICELLI, are the 15th century's most superb example of illustration in this medium.

As the first printed books did not appear in France until around 1470, the illustrated book in that country begins almost on the threshold of the 16th century. There was excellent work (for example, Pigouchet's *Book of Hours* of 1498) due to the mingling of foreign influences of German and Italian printers who set up presses in France and the books designed by Geoffroy Tory are elegant demonstrations of how the problem of combining decoration, illustration and print can be solved. His influence has extended to the designers of today who have often paid him tribute in pages which reflect his borders and ornamental initials. Jean Cousin, the painter; Jean Goujon, the sculptor, and Philibert de Lorme contributed their talents to the illustration of this period. In 1517, with the publication of the *Thewerdanck*, there appeared what is regarded by many as Germany's greatest achievement in the bringing together of text and pictures. This book is illustrated with woodcuts, but toward the end of the 16th century the popularity of copperplate engravings had grown until the woodcut almost disappeared except for the use of metal-plate media which added luxury and refinement to the making of books. Where the woodcut spoke in colloquialisms and everyday terms, the copperplate carried illustration to the limits of manner and style. But behind all was the desire to reproduce tone and shading in the picture and this could be done by crosshatching on the copperplate far more successfully than on the more primitive wood block.

**17th Century.** This preference for copperplate engraving lasted through both the 17th and 18th centuries. The work of the 17th century, although prolific, is extremely stylized and yields only occasional

flashes of originality and independence to show the way to new territory beyond. Sometimes Robert Nanteuil, the great French portrait engraver, contributed a frontispiece to a book or Jacques Callot allowed the wizardry of his etching needle to work on a few illustrative plates. Even Rembrandt made an etching for Herckman's *Zeevaert Lof* in 1634, but such work was for them only incidental and did not deal with the consecutive material of series of plates to translate into visual terms the narratives or discourses of literature. However, it is impossible to ignore, in the 17th century, the excellent atlases published in Holland with their handsome maps beautifully colored by hand, often heightened with gold, issued by Blaeuw and others.

**18th Century.** The 18th century was the golden age of ENGRAVING and in all the prints of that time with their ornamental borders and inscriptions, there seem to be illustrations of the thoughts which accompany the reader of a story or a work of philosophy. The engraved copperplate stated the subtle expression of that age better than any other medium. France led the world in the making of beautiful books and although many French books bore the imprints of London or Amsterdam, the plates were designed by French artists and faithfully transcribed on copper by French engravers. Hardly ever has there been such sympathetic reproduction of the personal quality of an artist's line as in the work of these craftsmen, each of whom was not only a perfectionist but could also infuse an individual style into his labors. The drawing was usually first etched on the plate with great and suggestive sensitiveness, then finished with infinite wealth of detail by engraving with the burin. This gave effects of light, dimension, and the illusion of the fleeting life of all things as no medium, single-handed, could ever do. The new style may be said to have been ushered in by an edition of Houdart de la Motte's *Fables*, illustrated by Charles Gillot in 1719.

Toward the beginning of the century there was a taste for large works which changed to the popularity of the many small books before the end. Sometimes both text and illustrations were engraved and the entire book printed from plates. Also, it was often the practice to have several artists work on one book and there were so many for this kind of task: Eisen, Gravelot, the Saint-Aubins, Cochin, Le Mire, Le Prince and Moreau le Jeune are only a few of them. Their grace and vitality will keep them alive as long as there is any taste left for the fine book. Among their outstanding achievements, many have called the edition of La Borde's *Choix de chansons* the finest book of the period and certainly there is no collection of secular music that can compare with it. Then there is what is perhaps the greatest fashion book of all time, *Le monument de costume*, with Moreau's engravings. There are also the edition of Molière (1734) with plates engraved by Cars after Boucher, the *Contes et nouvelles* of La Fontaine (1762), Boccaccio's *Decameron* (1757-61) in which a number of brilliant artists collaborated as was also true of Ovid's *Metamorphoses* (1761-71), but these are only the outstanding works of this time. In Germany is found the sturdy, straightforward work of Daniel Chodowiecki who stands out alone from an almost forgotten crowd of conscientious mediocrities. He was at his best in pictures of everyday simplicities of everyday life; when he tried to use more heroic material he became stiff and grandiloquent in the worst operative style.

English illustrated books did not reach any individual, original importance until the end of the century. There had been Pine's *Horace* (1733-37) with decorations and text both engraved, but it is not until the appearance of the poet-artist, WILLIAM BLAKE, that real genius is seen which showed the way to new possibilities in design and gave what is perhaps the most balanced combination of printed and pictorial language of all time. During the last half of the century the color plate book had become extremely popular.



PARKE-BERNET GALLERIES

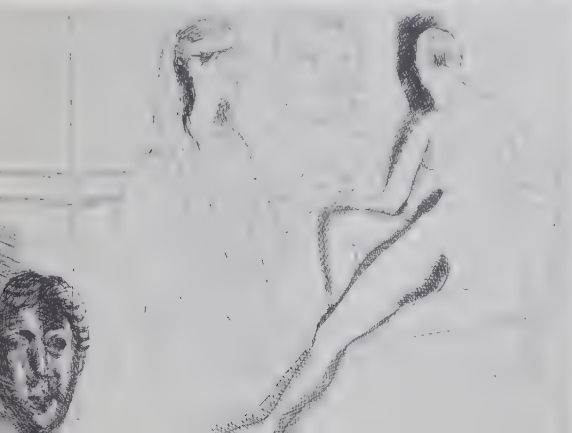
Woodcut illustration for early medical textbook



ART INSTITUTE OF CHICAGO  
Rowlandson picture from "Microcosm of London"



ART INSTITUTE OF CHICAGO  
Illustrative technique of Gabriel St. Aubin  
Picasso drawing for "Chef d'Oeuvre Inconnu"  
PARKE-BERNET GALLERIES



## Illustration



CITY ART MUS., ST. LOUIS  
"Claude Dernet," engraved  
illustration by Jacques Callot



PARKE-BERNET GALLERIES  
Water-color by G. Cruikshank for "Black Dwarf"



METROPOLITAN MUSEUM OF ART  
Biblical illustration by the poet William Blake



The illustrations were usually aquatints colored, after printing, by staffs of colorists who tinted the plates by hand. Using a separate plate to print each color was a process far too elaborate, tedious and expensive. Blake's books (among them *Songs of Innocence and Experience*, *America*, and *Jerusalem*) were etched in relief, not engraved or etched in intaglio, then hand colored by the author. There were not many copies of them but fewer artists have exerted such a long-lived influence as this great visionary. The vigor and meaning of these books have grown stronger with each passing decade. They did more than create a passing style or fashion, they are as timeless and full of resources as Michelangelo's sculpture or all the works of Leonardo and they form a bridge from the 18th to the 19th century which was so radically different with its new possibilities and problems.

**19th Century.** The man of the 19th century must have found life as complex and perplexing as it is found in the world of today. Science had grown to maturity and could contest religion, the people had come into politics, mechanical industry was supplanting craftsmanship while a new and actual familiarity with the world brought the wonders of strange lands and distant cities to each man's doorstep. Commerce was still a blessing. Never before had the printed book been such a factor in bringing people closer together. This was the beginning of a great age of reading. Pictures in books played an important part. They led many a child to learn to read. They filled men with nostalgia for travel and the life of old times. Illustrators had all the techniques of the past at their disposal and a new one which enabled them to reproduce cheaply and in great numbers the effects of pencil and crayon drawings. This was LITHOGRAPHY which was invented by Senefelder at the very close of the preceding century but which was not widely used until after 1800.

However, in England, Thomas Bewick, about 1770, had brought to life again the use of wood blocks in the printing of pictures. His method, however, was different from that of the old woodcut artists. With a graver instead of a knife, he made his designs on the hard cross-section of the block, not on the long and easier grain. Thus the picture was engraved in the wood instead of standing out in relief. His blocks have the delicate shading of copperplates and also achieve the vigor that only wood can give. The *History of British Birds* (1797) with his blocks, so full of observations of country life, storytelling settings and virile yet exquisite craftsmanship, is only one of a series of books illustrated by him. In 1821 appeared Thornton's *Virgil* with 230 engravings, all by hack artists, except one, William Blake, who produced 17 wood engravings for the First Eclogue. These stand with the greatest picture work ever made on wood and never have such modest pieces expressed such power or inspired so much good work. In another field, that of the aquatint, Thomas Rowlandson and Augustus Pugin collaborated on the famous plates for Ackermann's *Microcosm of London* which has been called—of course with many others—the greatest of English illustrated books. Caricature was popular and the many plates of George Cruikshank and Hablot K. Browne ("Phiz") appeared for years, their best-known work being the illustrations for Dickens. More serious was William Mulready who is seen at his best in the illustrations for *The Vicar of Wakefield* (1843). Most of the well-known artists of the period contributed to books, their designs being engraved on wood by the Dalziel brothers. Kate Greenaway and CALDECOTT set styles and attracted imitators with their simple and charming children's books, printed in color, as did Walter Crane. Aubrey Beardsley in a brief lifetime produced enough drawings (for printing they were reproduced by zincography which gives them an effect of woodcut), so original in their day that the 1890's have been called "The Beardsley Period" and their effect can be traced in the works of many of the expressionist

painters of later years. William Morris furnished illustrations for works published by his famous Kelmscott Press and many names like George Du Maurier, Charles Keene, John Leech, John Tenniel (with his famous pictures for *Alice in Wonderland*), full of association for almost every reader, bring the century to a close.

The introduction of lithography into France marked the beginning of a new era in French illustration. Baron Taylor's *Voyages pittoresques et romantiques* contained the work of many artists, among them Isabey and Richard Parkes Bonington, but the 18 lithographs by Eugène Delacroix for a French translation of Goethe's *Faust* probably had a greater and wider influence on illustration than the work of any other French artist during the first half of the century. Wood engraving, after its revival in England by Bewick, was enthusiastically received in France and there are hundreds of beautiful examples of its use in works illustrated by Gigoux (who contributed 580 cuts to an edition of *Gil Blas*, published in 1835), Daumier, Grandville, Raffet, Gavarni, Meissonnier, Daubigny. Nor must one overlook Manet's set of lithographs for the translation by Mallarmé of Poe's *The Raven* which leads us ahead in its style to the threshold of the 20th century and the works of Bonnard and Vuillard. But perhaps most familiar in this

period which was so rich in invention and the fine sense of form and craft was GUSTAVE DORÉ. His drawings were reproduced in line by the wood engravers. The best examples of his linear style are his illustrations for *Baron Munchausen* and Balzac's *Les contes drolatiques*. His *Don Quixote* and *Rabelais* (1873) show his attempts at creating tone and color from the black and white medium with the aid of grand and ornate compositions. Often engravers have misinterpreted his work.



F. J. MEINE

Illustration by Gustave Doré for "Baron Munchausen"

German illustration which had been in a dormant state since the 16th century had a reawakening toward the middle of the 19th. The work of Wilhelm Busch has a certain kinship with the early line drawings of Doré. His *Max und Moritz* is a comic book with little text, but there is an agile, simple beauty in every line. There was a wealth of folk tales and poetry: Kaulbach's pictures for *Reinecke Fuchs* by Goethe, Alfred Rethel's *Todtentanz aus den Jahre 1848* (a new Dance of Death of which Baudelaire was so fond), the beautiful line drawings, reproduced on wood, of Moritz Ritter von Schwind and Ludwig Richter have brought these wonderful stories to visual life. Adolf Menzel who illustrated Kugler's *Friedrich II* (1840-42) and later an edition of Frederick's works is usually looked upon as the greatest German illustrator of the century. There have been few with such gifts for bringing into pictorial art a sympathetic understanding of the text as Menzel did. He always gave preference to content and with him form created itself out of the needs of his expression with the result that his books are among the most virile, resourceful and original that have been produced in Europe.

**Illustration in America.** American illustration created a style of its own, and more and more its accomplishments came to be regarded as vigorous, fresh and uninhibited, and were much more than jobs well done. About 1840 there is found a large group of

artists at work. There is the great *Family Bible*, published by Harper's in 1846, which contained 1600 engravings by J. A. Adams, mostly from designs by J. G. Chapman. Soon after, there is met the work of Felix O. C. Darley who illustrated thrillers, Barnum's *Life*, the novels of Cooper, and whose finest book was Irving's *Sketch Book* (1848). New spirit was introduced by Howard Pyle whose drawings for *The Merry Adventures of Robin Hood* (1883) and Holmes' *The Autocrat of the Breakfast Table* are blended so well with the printed text. Edwin Austin Abbey with brilliant draftsmanship made a 19th century translation of the life and manners of the 17th and 18th centuries; Frederick Remington made the West true and actual, perhaps more so than the motion picture has done since; JOSEPH PENNELL drew architectural subjects for books of travel; A. B. Frost, with his pictures, helped to immortalize Uncle Remus and the rural scene; CHARLES DANA GIBSON created the Gibson Girl and illustrated the stories of Richard Harding Davis. These are only a few who enlivened American publishing, opened new paths for less original followers and made the illustrated book as much a part of American life as the newspaper. For American illustration had versatility, humor and a closeness to everyday life as well as a reaching out to the most extravagant dreams.

**20th Century.** As is true of all the other arts of the 20th century, illustration seems to be concerned more with the search for new and adequate forms of expression than with anything else. In recent times the best and most original work has been done first by great creative artists, then utilized for more commonplace needs by the professionals. The Americans, George Bellows in Donn Byrne's *The Wind Bloweth*; William Glackens in Dreiser's *A Traveller at Forty* and many other books; Rockwell Kent, notably in *Moby-Dick*; E. McKnight Kauffer (who has lived most of his life in England); Reginald Marsh, especially in Dreiser's *Sister Carrie* and John Sloan have all made important contributions and all are established painters. During

the last few years there has been so much encouragement of the illustrated book that one wonders why the results have not been better. Perhaps there has not been enough experimentation with new talent and too much belief that "big" names or bizarre treatment of material will build up a demand for the books in the market.

As in the 18th century, France has made the most beautiful books in the world in the 20th. This is due largely to the great picture dealer Ambroise Vollard who began publishing around 1900. His books were issued in small editions with the illustrations printed from the original plates, not mechanically reproduced as had become so common during the 19th century. Beginning with Verlaine's *Parallelement*, with lithographs by Pierre Bonnard, he has brought out many others which belong with the greatest art of today. Some of them are Balzac's *Le chef d'oeuvre inconnu*, illustrated by Picasso; *Le cirque de l'étoile filante* and André Suarès' *Passion*, with aquatints printed in color by Rouault; *Daphnis et Chloé*, with Bonnard's lithographs. At the time of his death Vollard had many projects for forthcoming books. Marc Chagall, for example, had executed plates for three important works: Gogol's *Dead Souls*, La Fontaine's *Fables* and the Bible, but these have never been published. Picasso's remarkable plates for a selection from the *Histoire Naturelle* by Buffon, also made for Vollard, were printed in France during the war. In Switzerland Skira published Mallarmé's *Poésies* with Matisse's etchings as well as *Les metamorphoses d'Ovide*, illustrated in a pure, classic style by Picasso. Derain has made color block cuts for *Gargantua et Pantagruel*, Raoul Dufy has produced one of the most charming modern books with *La belle enfant*, Dunoyer de Segonzac has contributed his sensitive dry points to several volumes, Aristide Maillol has illustrated *Daphnis et Chloé* with his expressive, powerful and simple woodcuts. Almost every significant modern artist in France has tried his hand at illustration.

Max Slevogt, Oskar Kokoschka, Max Liebermann, Lovis Corinth are a few of the modern German artists who have been illustrators. And there has been great pictorial activity in Russia. In England, from William Nicholson at the beginning of the century to Eric Gill, Clare Leighton, Barnett Freedman and Paul Nash, there has been great emphasis on craftsmanship, unity of typography and illustration. In fact, the characteristic of modern times has been to make the book a work of art and in many instances its primary function as a book has been overlooked. It is hoped that somehow a popular medium will be reached which will combine the best in illustration, typography and bookmaking so that any man—not only the connoisseur—who wants to own the books he reads will be able to have the best. The present age, with its great technical resources, mass production and talented artists, is the only time in which it is possible to accomplish this and—so far—not enough has been done.

HUGH EDWARDS

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**ILLYRIA**, or *Illyricum*, anciently the mountainous part of the Balkan Peninsula which lay alongside the Adriatic N of Epirus (Albania), being roughly coincident with the modern N Yugoslavia. The inhabitants were a mixed people, usually considered to have been akin to the ancient Thracians. Rude and pastoral, they were also addicted to piracy at sea; and although ruled by a number of petty chiefs, they managed to extend their power over Macedonia early in the fourth century B.C., until the energy and mili-



Illustration by Rockwell Kent for "Moby-Dick"



tary talents of Philip II, Alexander the Great, and Philip III completely overcame them. Pyrrhus, king of Epirus, seized a part of their territory, and in 228 B.C. their queen Teuta was compelled to yield a strip of the coast lands to Rome, as well as to pay a tribute. During the next two centuries the Illyrians made repeated attempts to shake off the Roman yoke, especially under Genthius in 168 B.C., but unsuccessfully, and in 35 B.C. Illyria was definitely made a Roman province. Although at first included in the Western empire, Illyria passed in 476 to the Byzantine empire. The country was invaded and settled by Slav tribes in the middle of the sixth century, but was for the most part subject to the rule of Hungary, Venice, and Byzantium, until it was finally captured by the Turks in the 14th century. The Roman emperors Valens, Claudius, Aurelian, Probus, Diocletian, and Maximian were all of Illyrian birth. In the 17th and 18th centuries the name Illyrians was used to indicate the Slavs who belonged to the Orthodox Greek Church. Napoleon created the Illyrian provinces in 1809, and in 1816 Austria formed the kingdom of Illyria, which embraced Carniola, Carinthia, Istria, and other territories. Again, toward the middle of the 19th century, attempts were made to fuse the nationalities of the southern Slavs—i.e., Serbians, Croats, and Slovenes, together into one common people, under the name of the Illyrian peoples. The scene of Shakespeare's *Twelfth Night* is laid in Illyria.

**ILMEN, LAKE**, fresh water basin, U.S.S.R., the Russian Soviet Federated Socialist Republic, in Leningrad Region, close to the city of Novgorod. The lake is a maximum of 25 miles from east to west and 19 miles from north to south with an area of more than 360 square miles. It lies only 93 feet above the level of the Baltic; its greatest depth is only 30 feet, its average depth  $6\frac{1}{2}$  feet. The banks of the Ilmen are flat and featureless.

**ILMENAU**, town and summer resort, Germany, in the state of Thuringia, at the N end of the Thuringian Forest, on the Ilm River, 30 miles by rail S of Erfurt. Here is the Goethe-House in which the German poet wrote the famous poem *Über allen Gipfeln ist Ruh* in 1780. There are hydropathic and other bathing establishments. Once noted as a mining center, Ilmenau now manufactures porcelain, glass, toys, and steel wares. From 1660–1920 it belonged to the grand-duchy of Saxe-Weimar. Pop. (1946) 16,500.

**ILMENITE**, an ore. See **TITANIUM**.

**ILOILO**, city, Philippine Islands, SE Panay, capital of Iloilo Province, situated on Iloilo Strait, at the mouth of the Iloilo River, opposite Guimara Island, which affords protection for the city's harbor; 258 miles SSE of Manila. Iloilo, the fifth largest city of the Philippines and the terminus of the railway running north to Capiz, is an important trade center and port. Exports include sugar, tobacco, coffee, rice, corn, hides, and hemp; imports are general merchandise. Coconut oil and palm wood products, lime, and vinegar are manufactured. There are a seminary and a cathedral here. An attempt by the Dutch Admiral Spielburg to take the city in 1616 was repulsed. Following the Spanish-American War the city was occupied by American troops in 1899, and was reopened to commerce in the same year. The city was bombed by Japanese planes in December, 1941, and was shortly thereafter taken by Japan in its Philippine campaign during World War II. United States troops recaptured the city in March, 1945, and found the harbor and the piers almost intact. The harbor became a United States naval base. Pop. (1948) 110,122.

**ILORIN**, city, W Africa, Nigeria, in the Northern Provinces, some 170 miles by rail NNE of Lagos, Nigerian capital. It has industries of woodcarving, leatherwork, pottery, and weaving. Its people are chiefly Moslems. Pop. (1952) 40,994.

**ILUS**, a Trojan hero, son of Tros and Callirhoe, and grandfather of Priam; was held to be the founder of Ilium or Troy.

**IMABARI**, city, Japan, Shikoku Island, on the N coast of Ehime Prefecture and the S shore of the Inland Sea, 20 miles NNE of Matsuyama, on the coastal highway and railway. During World War II the city was about three-fifths destroyed by American superfortress bombs. Pop. (1950) 60,191.

**IMAGE**. The use of images was not introduced into the churches of the primitive Christians, nor pictures, except in the form of symbols, such as the dove, the palm branch, the anchor, the fish, etc. So long as the church was engaged in mortal struggle with heathenism there was a strong feeling against images, as savoring of idolatry. Tertullian (*De Idololatria*) condemns even the art of the painter as unlawful. The Council of Eliberis (Elvira in Spain) in 306 resolved that pictures should not be used in churches. The early catacombs show only symbolic designs. It was not until the end of the fourth century that pictures of saints and martyrs were set up in churches. The sixth General (Trullan) Council, held at Constantinople in 692, enjoined that Christ should no longer be depicted merely under symbol of the lamb, but should be represented as a man. The second Council of Nice, in 787, sanctioned images of God the Father, the Holy Trinity, etc., in all the churches. At the same time distinction was carefully drawn between *latreia*, or adoration, and *douleia*, or reverence. It was also taught that even *douleia* must not be paid to the pictures or images, but only to the persons so represented. The habit of using images as helps to devotion grew rapidly; candles and incense, etc., were freely offered to them. Images were even used as god-parents in baptism. The superstitious would mix dust scraped from them with the eucharistic elements. This worship of images was the subject of heated controversy in the early church. In the 8th century a party of iconoclasts arose in the Eastern Church. The Emperor Leo III (the Isaurian) issued an edict in 726 forbidding honors to images. Another decree in 730 prohibited all image worship, under pain of death, as idolatrous. In spite of the opposition of Popes Gregory II and III, Leo and his successor, Constantine Copronymus, held their ground. This policy was continued more or less until the ninth century, when the worship of images was restored (842) by Theodora, widow of the Emperor Theophilus. The modern use of the Greek Church permits ikons, or pictures, but disallows graven images. The Roman Catholic Church strongly supports the use of images (Council of Trent, sess. xxv.). Charlemagne opposed the decrees of the second Council of Nice (787) in favor of images, and was supported by Alcuin. The English Church of that date seems to have generally repudiated image worship, as also did the council at Frankfurt, at which were present British, Gallican, German, and Italian bishops. They were afterward freely introduced into Britain, as the records of the reforming iconoclasts of the 17th century prove. The Lutheran Church still permits their moderate use. See **ICONOCLASTS**; **IDOLATRY**.

W. G. D.

**IMAGE**, optical. See **OPTICS**.

**IMAGINARY NUMBER**. See **COMPLEX NUMBER**.

**IMAGINATION**. Traditionally, imagination has been identified with imagery or the capacity to see things not present to the senses. Imagination is, however, much more than mere reproduction of former experience. It implies new experience, and is frequently the product of a need or desire on the part of the individual. Imagination may be defined as the capacity to give ordinary experience novel implications in the service of certain satisfactions.

The subject matter of imagination may be divided under the captions—controlled and uncontrolled imagination. In reverie or **DAYDREAMING**, play, and night dreaming we allow ourselves considerable freedom in the play of inner impulses. Mastery and love, the dominant motives in daydreaming, plunge us into strange and often implausible adventures which are strangely satisfying. In reverie there is a tacit understanding with ourselves that such bizarre excursions

are permissible. In DREAMS during sleep this conscious permission is lacking. The standards of practical judgment, consistency and decorum are powerless. In dreams during sleep unconscious drives seek their satisfaction while conscious control is in abeyance.

The play of children differs from adult reverie in that the reverie is enacted. When children use chairs as horses, sticks for guns, and converse with dolls, their reveries are acted out. Make-believe games are not the only games that the child plays. The child enjoys problem-solving games and constructing things with objects around him. In problem-solving and in building, the child's thoughts are directed to a goal and his imagination becomes creative.

Creative imagination and reasoning are closely related. (See LITERATURE; POETRY.) Psychologists have studied the thinking process by analyzing the behavior of human beings and animals in solving problems. The mental processes of reasoning and imagination overlap. In reasoning, facts have to be fitted together to form a hypothesis which stands or falls on the basis of whether or not the solution follows. Hypothesis formation is the phase of reasoning where free choice of possibilities is great, and it corresponds to the free play of ideas in imagination. Psychologists have wondered how the hypothesis becomes formulated in great inventions. One interesting theory is that we have to break away from "blind alleys" that persist in prolonged thinking in order to get a fresh start in a new direction. Inventors have been known to drop their problems, seek relaxation in the theaters or social gatherings, and thus suddenly they found solutions of some of their most vexing problems. In great inventions, such spontaneous solutions have the character of inspiration. The claim has been made that these intuitive flashes are of unconscious origin.

The best tests of imagination are special picture tests. The child or adult is asked to tell a story about the picture. Meaningless pictures, like ink blots, are popular. A person is asked to tell what things can be made out of the blots. Series of pictures and ink blots have been standardized and are known as PROJECTIVE TECHNIQUES because people often see things in the ink blots or interpret a picture in a way that reveals their inner anxieties. Thus, projective techniques not only test one's imagination but also one's deep underlying motives.

T. KARWOSKI

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**IMAGISM**, an antiromantic movement in English and American poetry, had a brief but extensive vogue among advance-guard writers of the period 1910–17. Its doctrines, developed by the American poet EZRA POUND from the esthetic theories of T. E. Hulme, called for a precise, unembellished reproduction of the fugitive, poetic vision, and resembled in many respects the "static art" theories of the French PARNASSIANS. The group's manifestoes appeared in the anthologies *Des Imagistes* (1914) and *Some Imagist Poets* (1915). Notable exponents of Imagism were Pound, Amy Lowell, Richard Aldington, H.D., and John Gould Fletcher.

**IMAGO**. See INSECT.

**IMAM**, a title used in connection with various recognized leaders in Islam. The term is applied to the one who recites and leads the prayers of the faithful in Mohammedan worship, and the title is also given by the Shiites to the caliphs who are regarded as the legitimate followers of ALI. The title is sometimes applied to a person who is regarded as an authority in either law or theology.

**IMANDRA LAKE**, U.S.S.R., the chief fresh water basin of Russian Lapland, in the Russian Soviet Federated Socialist Republic, Murmansk Region, in 67° 30'–68° N lat. The lake is sometimes called the Lesser Imandra, to distinguish it from Inari, or Greater Imandra, in northern Finland. It is about 65 miles in

length from north to south by six miles from east to west. The lake drains into the northwestern end of the White Sea. Its fisheries are profitable during the summer months.

**IMANTOPHYLLUM**, a genus of bulbous plants belonging to the family *Amaryllidaceae*. They are conservatory or cool greenhouse plants, thriving in a light, fibrous loam containing a fair proportion of leaf mold. Propagation is usually effected by means of offsets.

**IMATRA FALLS**, waterfalls, Finland, in the department of Viipuri, in the Vuoksi River, issuing from Lake Saimaa on its way to Lake Ladoga. In a channel from 50 to 125 feet wide, the river falls more than 60 feet in about 2,000 feet. One of Finland's largest power plants is at Imatra.

**IMBECILITY**, the middle grade of mental deficiency. Imbeciles have more intelligence than idiots, but less than the group known as "high grade mental defectives" (formerly called "morons"). In terms of social competence imbecility is defined as mental defect so severe that the individual is incapable of managing himself or his affairs or of being taught to do so. In the technical psychological sense, imbeciles are individuals whose mental development at maturity is that of a child between the ages of three and seven; the I.Q. range is from 20 to 50.

Although the causes of a few types of imbecility are known to be glandular or neurological (such as thyroid gland deficiency or brain damage), the vast majority of imbeciles are individuals in whom no physical cause of the mental deficiency can be found. Most imbeciles can not profit from schooling; hence are not accepted even in ungraded classes of public schools. They are usually cared for in state institutions for the feeble-minded.

M. A. SAFFIR

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**IMBODEN, JOHN DANIEL**, 1823–95, American Confederate soldier, was born near Staunton, Va., and studied at Washington College. He practiced law at Staunton and was state representative. As brigadier general during the Civil War, he fought at Cross Keys and Port Republic under Jackson; he led the Imboden Raid (1863). He protected Lee's left flank during his advance north, covered the retreat from Gettysburg, and captured the Federal garrison at Charleston. After the war he was interested in the development of Virginia's natural resources, writing *The Coal and Iron Resources of Virginia* (1872).

**IMBROS**. See IMROZ.

**IMITATIVE BEHAVIOR** is a form of conditioned behavior and is not now regarded as instinctive. Nor is doing what others do imitative unless their behavior serves as a model and stimulus. Imitative behavior may be either unconscious or conscious and purposive. It occurs on three levels: (1) the direct imitation of persons, (2) the imitation of models in literature and art, and (3) the imitative acceptance of concepts and principles. The primary social function of imitation is the absorption of accumulated culture by the individual, thus permitting more rapid social advance than would be possible through original invention.

L. L. BERNARD

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**IMLAY, GILBERT**, c. 1754–c. 1828, American author and political adventurer, was probably born in Monmouth County, N.J. After serving in the Revolutionary War, he went to Kentucky in 1784 where he became a deputy surveyor and land speculator. Involved in legal difficulties, he apparently left North America in 1786. In London he published *The Emigrants* (1793), one of the early romances of the western frontier. In France he planned to join Brissot in an expedition to seize Louisiana from Spain but Brissot's downfall precluded this scheme. He lived for a time with Mary Wollstonecraft who bore him a child and deserted her after she had helped him untangle his business affairs in the Scandinavian countries.

**IMMACULATA COLLEGE**. See COLLEGES.





LOUVRE, PARIS

"Immaculate Conception," by Bartolomeo Murillo

**IMMACULATE CONCEPTION**, a dogma held by the Roman Catholic Church which declares that MARY, the Virgin, the mother of Jesus, was without sin from the moment of her own conception. Although the New Testament does not refer to the conception of Mary, the history of the dogma dates back to the ancient Church. Many early Christians held the belief that Mary was sinless after the birth of Jesus. This soon led to the idea that she was sinless after her own birth and, finally, to a belief in her sinlessness from the moment of her own conception. The fact that Mohammed knew of the doctrine indicates that the early Christians in the Asiatic churches accepted the belief, although it never became an officially recognized dogma of the Eastern Church.

**History.** In 1139, Bernard of Clairvaux (1091-1153) opposed the observance of the Feast of the Immaculate Conception in the cathedral of Lyons, claiming that it lacked papal sanction. A prolonged controversy over the doctrine developed during the 14th century. The Thomists and Dominicans, following Thomas Aquinas (1225-74), were opposed to the Scotists and Franciscans, under the leadership of Duns Scotus (d. 1308), who held strictly to the doctrine. The council of Basel (1431-49) favored the doctrine, as did also the Society of Jesus (Jesuits), the pronouncements of Pope Sixtus IV and the decrees of the Council of Trent. In 1622, Pope Gregory XV issued a decree forbidding all (except Dominicans within their own order) to teach anything contrary to the sinlessness of Mary. Pius IX, in 1854, published the bull, *Ineffabilis Deus*, which declared that Mary "was kept free from all stain of original sin." According to Catholic doctrine, Mary remained free from sin throughout her life, the "brethren of the Lord" (I Cor. 9:5) being considered not brothers but kinsmen. The sinlessness of Mary is thought by Catholics to be the result of divine grace or privilege, as distinguished from the sinlessness of Christ who is considered innocent of sin by virtue of his nature or inherent excellence. The Feast of the Immaculate Conception is celebrated December 8. W. G. D.

**IMMACULATE HEART COLLEGE.** See COLLEGES.

**IMMANENCE**, the quality of dwelling within; specifically the theological use of the term as signifying the indwelling presence of God in man and nature.

## Immigration

Immanence may be contrasted with transcendence which holds that God is above or outside of nature. **PANTHEISM** is based upon an immanent conception of God, whereas **DEISM** emphasizes the purely transcendent nature of God apart from the world which He has created. There has been a tendency in most of the major monotheistic religions to develop a theology which regards divine immanence and transcendence as complementary rather than exclusive, though individual theologians and different schools of thought may emphasize either the conception of God's immanence or his transcendence. In general Roman Catholicism has favored the transcendental interpretation of God, while certain Protestant denominations, such as the Friends, emphasize the immanence of the Deity. See FRIENDS, SOCIETY OF.

**IMMANUEL** or **EMMANUEL**, a name occurring in both the Old and the New Testaments. In Isaiah 7, Immanuel is referred to as the son of a virgin whose birth and experiences were to be a divine sign to Ahaz, the king of Judah, during the war with Syria and Ephraim. The interpretation of this passage is difficult, but apparently it forms the basis for the reference in Matthew 1, 22 ff. to Jesus as Emmanuel, the fulfillment of the Old Testament prophecy. The phrase "and they shall call his name Emmanuel" (Matt. 1, 23) accounts for the common application of the name Emmanuel (or Immanuel) to Jesus Christ.

**IMMERMANN, KARL LEBERECHT**, 1796-1840, German novelist and dramatist, was born in Magdeburg. After fighting at Ligny and Waterloo under Blücher, he entered the Prussian state service, and became acquainted with his lifelong friend, the Countess von Ahlefeldt. Besides the humorous idyllic romances of *Die Epigonen* (1836) and *Münchhausen* (1839—a double work, one half bearing the separate title of *Der Oberhof*), he wrote numerous plays. His collected works (20 vols.) were published in 1883.

**IMMERSION.** See BAPTISM.

**IMMERSION FOOT** and **TRENCH FOOT** are closely related conditions caused by prolonged exposure of the feet to cold and moisture. Immersion foot was common during World War II in those who were torpedoed or shot down at sea and had to spend days or weeks in small boats with their feet constantly wet by cold water. Trench foot was similarly acquired by long continued contact with cold water or cold, wet shoes in the trenches. The principal effects of cold water on the feet are interference with the circulation of blood and damage to the skin. The best treatment is prevention, but when the feet have been injured in this way they should be warmed slowly rather than rapidly. Rubbing should be avoided. Sometimes the damage is so great that amputation of the foot or part of the leg is necessary. Most of those who have recovered reasonably well remain susceptible to exposure to cold. EDWIN P. JORDAN, M.D.

## IMMIGRATION

*For centuries men have usually moved westward seeking new lands and new governments*

**IMMIGRATION AND MIGRATION.** The migration of people from one area of the world to another has gone on from the beginning of time. The various cultures and civilizations in the world present and past are the result essentially of the adaptations made necessary by the new environment on the ideas, institutions, and mode of living carried to the new area by the migrants. Until modern times migration was usually a racial, national, or tribal undertaking. The migrations of the barbaric tribes of Europe—the Goths, the Huns, and others about A.D. 300-500—are well known. These were often in the form of military movements. In other cases, the migrations were essentially colonizing expeditions. Carthage was the



U.S. DEPARTMENT OF JUSTICE

### Immigrants Arriving in New York City

result of Phoenecian colonization. After 1500, such movement tended to become individual or in family groups although occasionally entire communities migrated.

**Early Migrations.** Throughout history the direction of migration has been westward—from Asia to Greece to Rome, to western Europe, and then to America. Because agriculture was the main occupation until comparatively recent times, and since a given area of land under an agricultural economy will support only a given population, the movement is usually from a denser to a sparser settled region.

The obvious cause for migration is the belief that another area offers greater opportunity than does the home community. Positively, the new land may be more fertile, economic resources greater, or climate and environment highly congenial. Negatively, the home land may have become too crowded, social and economic classes may be too rigid, political or religious laws disagreeable, or climatic changes may have taken place. Because home ties are strong, it usually has required a combination of causes to induce any large scale migration. Furthermore, the individual must be adventuresome and optimistic to strike out into a new community.

Since the reasonably successful people have less incentive to move, it is mostly the unsuccessful with ambition who migrate. Therefore some aid has usually been necessary since 1500 for the benefit of these migrants. Such aid has taken various forms. Sparsely settled lands have offered bounties to immigrants. In the American colonies the indenture system developed by which an immigrant bound himself to a period of labor, usually seven years, to pay for his passage. Governments both permitted or required convicts to migrate to colonies. Later, American railroads, having received from the government large areas of land, sought to induce immigrants to settle on them by paying for their passage or lending money. When the industrial revolution in America required a tremendous increase in the number of workers, industries similarly contracted for immigrant labor. Frequently, governments have assisted immigration by grants or special privileges. Earlier immigrants frequently assist later immigrants, especially other members of the family, by sending travel money.

**Migrations Since the Industrial Revolution.** Until the industrial revolution permitted a larger population, the number of people who could be supported by a given amount of land was small and relatively static. Hence the number of migrants at various times in the past was insignificant when compared with the numbers who left Europe in the 19th century. But in proportion to the total population, the number was often great. Similarly today the extent of migration must be measured both in terms of numbers and in terms of proportion of immigration to the total population.

In the 19th and 20th centuries, about 60 per cent of the total world migration was to the United States. About 11 per cent went to Canada and 10 per cent to

## Immigration

the Argentine. Other countries receiving large numbers of immigrants were Brazil, Australia, New Zealand, and South Africa. About 90 per cent of the total came to the two Americas. Argentina, Canada, and the United States, in that order, have had the largest ratio of immigration to population. In the 19th century about 15 million or 40 per cent of all immigrants came from the British Isles. During the same century about six million came from Germany.

The United States has a combination of the two requirements of making land attractive to immigrants; it is sparsely settled even now in comparison to Europe, and it has tremendous natural resources including unbelievably fertile land. In addition, the varying climate and geographic conditions generally have attracted Europeans. The ideals of democracy, religious liberty, social equality, and economic freedom found in the United States were significant lures, furthermore, to dissatisfied, oppressed, unsuccessful but ambitious Europeans. The result has been to bring most of the people who left Europe during the past 300 years to the United States. The various institutions and cultures carried along have been modified by both the environment and the cultures of other peoples who were also seeking to establish homes here. The end result has been a new nation, a new people, with institutions derived from all the peoples of the Old World. There has been a melting pot problem, but from all melting pots there emerges a new product embodying the characteristics of the elements that went into it. So has it been with America.

**History of American Immigration.** Immigration to the United States began with the arrival at Jamestown of the first colonists. The number of immigrants arriving during the colonial period has been variously estimated from 100,000 to 350,000. Authorities tend toward the latter figure. Most of the colonial immigrants came from England. They scattered along the coast and throughout New England. During the 17th century they made up the bulk of the population, but in the 18th century immigrants also came from other European countries. Germans, settling in New York, central Pennsylvania, and the western part of the southern colonies, numbered about one tenth of the total population at the end of the colonial period. Approximately the same number of Scotch-Irish arrived; by 1775 they were found in the interior of all the colonies from New York southward. French Protestants, Irish, Scotch, Scandinavian, and Jews were the next most populous groups. In addition there were some Dutch, Welsh, Portuguese, and Swiss.

In 1775 New England remained predominantly English, but the rest of the colonies had considerable elements from other countries. The tendency of the non-English peoples to settle in separate areas, creating a situation similar to that found in larger American cities today, antagonized the earlier settled English-Americans. At the same time, the non-English added their contribution to the American culture and contributed many leaders in the Revolution. Some eight or ten groups were represented in the Continental Congress.

During the Revolution immigration practically ceased and until 1830 there was no great stream from Europe. Only 8,000 arrivals were recorded in 1820; many more may have entered than those recorded, however, because of the laxity at the ports. As can be seen in the following table, the first great wave of immigrants arrived in the 1830's. Thereafter the numbers swelled in each decade until the Civil War. After the war, the trend was resumed until during the first decade of the 20th century twice the 1790 population entered the country.

**Trends in Immigration.** As a result of this rush of Europeans to America, almost one sixth of the population in 1910 was foreign born and almost half was either foreign born or composed of children of foreign parents. The effect of such events as the Irish



potato famine, the German revolutions of 1848, and the Russian May Laws of 1882 are reflected in the annual immigration figures. For example, in 1882 four times as many migrants left Russia as in 1881. Likewise the American panics of 1837, 1857, and 1892, the Civil War, and similar discouraging conditions quickly caused a decline in the annual totals. Especially desirable conditions such as the Homestead Act, which granted 160 acres of land to citizens or those who declared their intention of becoming citizens, caused an increase in the number of foreigners coming to America. For example, during the first years of the Civil War only about 92,000 entered in comparison with the 300,000 to 400,000 during the

IMMIGRATION TO THE UNITED STATES  
BY DECADES

| IMMIGRANT ALIENS<br>ENTERING |           | IMMIGRANT ALIENS<br>ENTERING |           |
|------------------------------|-----------|------------------------------|-----------|
| 1821-30                      | 151,824   | 1891-1900                    | 3,687,564 |
| 1831-40                      | 599,125   | 1901-10                      | 8,795,386 |
| 1841-50                      | 1,713,251 | 1911-20                      | 5,735,811 |
| 1851-60                      | 2,598,214 | 1921-30                      | 4,107,209 |
| 1861-70                      | 2,314,824 | 1931-40                      | 528,431   |
| 1871-80                      | 2,812,191 | 1941-50                      | 1,035,039 |
| 1881-90                      | 5,246,613 | 1951-55                      | 1,087,638 |

preceding years (427,800 in 1854). But in 1863, a year after the Homestead Act was passed, a definite upswing took place.

Another factor to be considered in analyzing 19th century immigration to the United States is the composition of the waves of immigrants. During the early years of the century the British made up the bulk of the newcomers. But by 1840 both the Germans and the Irish were far outnumbering the English. Shortly after the Civil War the Scandinavians began coming in increasing thousands, also passing the English in the 1880's.

In the next decade, 1890-1900, the immigration statistics show that a radical change had taken place in the nationalities coming to the United States. In each ten-year period up to 1890 at least 70 per cent and sometimes 90 per cent of the immigrants had come from northern and western Europe, that is, from the British Isles, Germany, France, Scandinavia, the Netherlands and Switzerland. After 1890 the majority of immigrants came from eastern and southern Europe—Italy, Austria-Hungary, Russia, Poland, and the Balkans. By the end of the century 70 per cent of the total immigration was from this area. The following table shows clearly how the immigration to the United States changed.

SHIFT FROM THE "OLD" TO  
THE "NEW" IMMIGRATION

| YEARS          | PER CENT<br>FROM N.<br>AND WEST<br>EUROPE | PER CENT<br>FROM S.<br>AND EAST<br>EUROPE | TOTAL<br>PER CENT<br>FROM<br>EUROPE |
|----------------|-------------------------------------------|-------------------------------------------|-------------------------------------|
|                |                                           |                                           |                                     |
| 1821-30.....   | 68.0                                      | 2.2                                       | 70.2                                |
| 1831-40.....   | 81.8                                      | 1.0                                       | 82.8                                |
| 1841-50.....   | 93.0                                      | .3                                        | 93.3                                |
| 1851-60.....   | 93.6                                      | .8                                        | 94.4                                |
| 1861-70.....   | 87.8                                      | 1.4                                       | 89.2                                |
| 1871-80.....   | 73.6                                      | 7.2                                       | 80.8                                |
| 1881-90.....   | 72.0                                      | 18.3                                      | 90.3                                |
| 1891-1900..... | 44.6                                      | 51.9                                      | 96.5                                |
| 1901-10.....   | 21.7                                      | 70.8                                      | 92.5                                |
| 1911-20.....   | 17.4                                      | 58.9                                      | 76.3                                |
| 1921-30.....   | 31.3                                      | 29.0                                      | 60.3                                |
| 1941-50.....   | 47.2                                      | 12.8                                      | 60.0                                |
| 1951-53.....   | 52.5                                      | 13.8                                      | 66.3                                |

The period 1941-50, including World War II, saw marked changes in immigration. Arrivals from northern and western Europe returned to their former dom-

inant position in relation to immigrants from southern and eastern Europe. Immigrants from all parts of Europe accounted for 60 per cent of the total, the lowest percentage for any decade in U.S. history. During 1941-50 immigrants from Canada, Mexico, and other American countries comprised 34.3 per cent of the total. During 1951-53, 52.5 per cent of the immigrants came from northern and western Europe and 13.8 per cent from southern and eastern Europe, while 29.1 per cent of the immigrants came from American countries. In 1955, 53.3 per cent came from Europe and 40.3 per cent from the Americas.

**Hostility Toward Immigrants.** Hostility by some Americans toward newcomers has existed throughout U.S. history. In the colonial period, descendants of the original English settlers viewed with consternation the influx of Germans and Scotch-Irish. The large numbers of arrivals in the 1840's led to the formation of the Know-Nothing Party, dedicated to restricting the rights of immigrants. New waves of protest followed the arrivals of the southern and eastern Europeans in the 1890's. The cry against immigrants led finally to the restrictive legislation of the 1920's.

**Immigration from Other American Countries.** Europe has accounted for most of the immigration to the United States. Most of the other arrivals, especially in the 20th century, have come from the other American countries, particularly Canada and Mexico. In the case of Canada, there has been movement in both directions, with about twice as many Canadians coming to the United States as U.S. nationals going to Canada.

The number of Canadians coming to make their homes in the United States has increased until the number of Canadian-born who live in the United States equals about one-tenth of the total Canadian population. Twice as many U.S. nationals migrate to Canada each year as do British citizens.

Almost half a million Mexicans entered the United States during the last decade of unrestricted immigration. The West Indies are the source of greatest American immigration to the United States after Canada and Mexico.

**Asiatic Immigration.** Although immigration from Asia has constituted only 2 per cent of the total immigration since 1800, it has been especially significant. It has caused the greatest friction and it resulted in the first immigration restriction laws. Until the middle of the 19th century less than 100 Asiatics arrived. The discovery of gold in California and the building of the first transcontinental railroad (nine tenths of the laborers employed in the construction of the western half were Chinese) stimulated Chinese immigration. In 1882, 39,600 arrived. This was the peak year. Most of the Chinese settled on the West Coast and even the first arrivals were greeted with acts of hostility ranging from discriminating laws and special taxes to riot and murder. After 1882 Chinese immigration was prohibited, although the Burlingame Treaty of 1868 had provided for this immigration. The treaty provision was avoided by suspending the immigration for temporary periods until 1902 when the suspension was made indefinitely. Since the Chinese did not bring their families, the result has been a diminishing Chinese population in the United States. See UNION PACIFIC RAILROAD.

The Japanese did not come until later. In 1900 there were about 24,300, and in the next decade 129,800 arrived. Almost nine tenths were located in the Pacific Coast states. Unlike the Chinese, the Japanese brought their families and engaged in agriculture and mercantile pursuits. California and neighboring states imposed discriminating legislation against them and sought Federal legislation banning further immigration. Because of Japanese opposition to being singled out as a country whose citizens were not welcomed in the United States, Congress hesitated, but in 1907 the Gentlemen's Agreement was made



Chinese Immigrants in this old print are being searched for opium on their arrival in San Francisco

HARPER'S WEEKLY

with Japan, by which the Mikado's government restricted migration of Japanese to the United States, making unnecessary an American law.

In 1924 Asiatic immigration came to an end when a law was passed barring entry for permanent residence to those persons not eligible to citizenship. All Orientals were thereby affected. An act of 1943 removed the restriction against Chinese, giving them a quota of 105. Legislation which technically ended the ban against admission and naturalization of other Asiatics was passed in 1950; however, the very low quotas set up served to limit the number of immigrants. The principal effect was to make legally-resident Asiatics eligible for naturalization.

**Movement for Restriction.** Newly arrived immigrants to the United States, living in their own communities, sometimes ignorant, illiterate, and poor, contrasted sharply with the native Americans, many of whom feared the immigrants would lower the existing wage level and would fail to be assimilated or Americanized. The fears and opposition resulted in the passage of laws designed to regulate and restrict immigration.

Other factors contributed to the new policy of immigration restriction. While the United States had had millions of acres of unoccupied fertile land, labor had been scarce and immigrants were of economic value to the country. As the country filled up and the frontier line disappeared by 1890, there was some basis for the opposition to cheap labor.

The first immigration laws were primarily selective. In 1882 the Chinese were barred. At the same time a law was passed excluding convicts, idiots, and persons likely to become public charges. From that time on, other groups—the diseased, paupers, polygamists, prostitutes, anarchists, were typical classes—were prohibited entry. In 1917 a literacy test was required of all persons seeking entry. Some 30 attempts were made to pass such a law before it was finally enacted.

**Restriction by Quotas.** The old laws were based on the principle of selecting immigrants, but by 1917 Congress was pondering a method by which the total immigration could be limited as well. The result was a law passed in 1921 which restricted immigration from each country to 3 per cent of the persons of that nationality residing in the United States in 1910. Oriental immigration was completely banned and that from Canada and Latin America was not included in this general law. If the quotas had all been filled 357,803 would have been admitted. Actually only 215,000 were admitted from Europe during the next year. Three years later the law was amended so as to restrict further the total number, and to select those admitted in favor of the northern and western Europeans. Only 2 per cent instead of 3 per cent were to be admitted and the year 1890 instead of 1910 was made the basis in computing individual

## Immigration

national quotas. It was not until the 1890's that southern and eastern Europeans began to outnumber the rest of Europe in coming to America and by basing quotas on the number in the United States in 1890, their quotas were made smaller. The quota for northern and western Europe was reduced from 250,058 under the 1921 law to 143,312, while that for eastern and southern Europe was cut from 157,160 to 16,847; the first was reduced 42 per cent, the latter 89 per cent. These laws were in terms of the immigrant's last place of residence. Hence a European could migrate to Canada or Mexico and after residing there for a year (later five years) could enter the United States under the terms provided for those American countries.

**The National Origins System.** When the 1924 law was enacted, it was to be temporary while Congress studied a basis for a permanent law. The permanent one went into effect in 1929 and was based on a new principle. It limited all quota immigration to a total of 150,000. The quota for each country was a proportion of the 150,000 total, that is, it was the ratio of the number of people of that national origin to the total U.S. population in 1920. For example, it was estimated that 17.3 per cent of the population in the United States in 1920 (105 million) was of German descent. Therefore, Germany was given a quota of 17.3 per cent of 150,000 or 25,957. Quotas for other countries were similarly computed, and a minimum of 100 was set. Place of birth rather than place of last residence was to determine the quota to be applied. The total of quota immigration was revised slightly several times after 1929; in 1955 it was 154,657.

### IMMIGRATION QUOTAS BY PRINCIPAL COUNTRIES OF ORIGIN

|                                              |        |                          |       |
|----------------------------------------------|--------|--------------------------|-------|
| Great Britain and Northern Ireland . . . . . | 65,361 | France . . . . .         | 3,069 |
| Germany . . . . .                            | 25,814 | Czechoslovakia . . . . . | 2,859 |
| Ireland (Eire) . . . . .                     | 17,756 | U.S.S.R. . . . .         | 2,697 |
| Poland . . . . .                             | 6,488  | Norway . . . . .         | 2,364 |
| Italy . . . . .                              | 5,645  | Switzerland . . . . .    | 1,698 |
| Sweden . . . . .                             | 3,295  | Austria . . . . .        | 1,405 |
| Netherlands . . . . .                        | 3,136  | Belgium . . . . .        | 1,297 |
|                                              |        | Denmark . . . . .        | 1,175 |

The 1924 and 1929 laws denied entrance to persons not eligible to American citizenship (Asiatics), but in 1952 this disability was removed and all Asiatic countries were included under the quota system. Persons from Western Hemisphere countries may enter outside the quotas. Actually, since many countries do not fill their quotas, and since any excess from one country cannot be transferred to another country, the number of quota immigrants never reaches the maximum. In the fiscal year ended June 30, 1955, 237,790 immigrants entered the United States, the largest number since 1929. Yet in 1955 only 82,232 immigrants came in under quotas, the lowest number since World War II. Of the 155,558 nonquota immigrants in 1955, 50,772 came from Mexico, 23,091 from Canada, 12,499 from the West Indies, and 9,969 from other Western Hemisphere countries; in addition, 29,002 entered under the Refugee Relief Act.

Mention has been made of quota immigration. Provision was made in the National Origins Immigration Law to permit the entry of persons who do not intend to reside permanently in the United States. The law defines an immigrant as any alien departing from the United States from any place outside the Western Hemisphere, with the following exceptions: (1) government officials with their family, servants and attendants; (2) tourists and businessmen on temporary visits; (3) aliens in continuous transit through the United States; (4) aliens lawfully admitted, but passing in transit through foreign contiguous territory; (5) bona fide alien seamen in the pursuit of their calling; (6) aliens previously lawfully



admitted and returning from temporary visits abroad; (7) aliens entitled to enter the United States solely to carry on trade under and in pursuance of the provisions of a present existing treaty of commerce and navigation; (8) bona fide students, teachers, ministers of religion with their families, but not including children over 18 years of age.

Other countries which in the 19th century were on the receiving end of world migration have recently passed similar laws restricting and selecting immigration. The result has been a very definite slowing down of the movement of world population. See EMIGRATION; MIGRATION OF PEOPLES AND CULTURES; REFUGEES.

FRANK L. ESTERQUEST

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**IMMORTALITY**, the state of everlasting existence after physical death. The term has been variously used with reference to: (1) the resurrection of the body (a belief held by relatively few people in the world); (2) the survival of the soul or personality after death; (3) biological immortality, or survival through descendents; (4) immortality of personal influence, through the perpetuation of ideas, inventions and works. In addition to these types of immortality there is the Hindu concept of eventual absorption, after many future lives, into the Universal Spirit, which might be considered a kind of immortality, although it is impersonal in nature. *Nirvana*, or complete extinction of the personality, which is the desired ultimate goal of the Buddhist, can hardly be considered as immortality. Biological and influential immortality are not, generally speaking, controversial issues nor the specific concern of religion, but neither type of immortality is considered sufficient by those who believe in a conscious continuation of personality.

The history of a belief in personal survival after death is as old as the history of man, the first evidences of a belief in survival appearing in the New Stone Age about 50,000 years ago. Food, tools, and weapons were left in the tombs of the dead, evidently as provisions for a life after death. The Egyptians believed that the spirits of the departed went to the underworld to be judged. However, they apparently believed in the eventual reunion of the soul and the body since they attempted to preserve the body by embalming and elaborate entombment. The Babylonians and Assyrians also conceived of a temporary dwelling place for departed spirits but believed that true immortality began only with the resurrection of the body. It has sometimes been supposed that the Hebrews had no belief in a future life, but a careful study of Old Testament writings does not point to such a conclusion. Although Hebrew literature is apparently little concerned with the question of personal immortality, the story of Saul and the witch of Endor (I Sam. 28:3-18) and the references to the giving up of "the Ghost" (Gen. 25:8; 35:29) and to *Sheol* as the city of the dead, leads to the conclusion that they did believe in spiritual existence. Evidently they believed that the soul survived in a state which somewhat resembled sleep, judging from the few scripture passages which throw light on the subject. The Greeks did not believe in the resurrection of the body, but the great philosophers were believers in personal survival. Socrates taught that death frees man from the power of the material world. Plato and Aristotle also believed in the indestructibility of the intelligence.

The early Christian view emphasized the resur-

rection of the body—a spiritual body transformed and glorified (I Cor. 15:44, 52). The belief in the immortality of the soul was based upon the account of the resurrection of Jesus and his teachings. Added support for the doctrine came from the argument that it is only through immortality that the righteous could receive their just rewards and the wicked the punishments which they deserved. The immortality of the soul is accepted by many modern Christians who reject the early, orthodox doctrine of the resurrection of the body.

A doctrine of immortality which has been held by some Christians is that which is known as *conditional immortality*, an eschatological theory which maintains that the soul is naturally mortal and that immortality is only to be attained as the free gift of God. According to this theory, even though all men may rise again and be judged, this resurrection does not imply the eternal existence of the wicked. They are to suffer such punishments as their offenses warrant, and then undergo annihilation, so that their "everlasting" punishment consists in their eternal exclusion from life. Only the righteous, by the free grace of God, are granted the privilege of immortality.

The development of the modern scientific method and the growth of materialism has contributed much to the skeptical attitude toward immortality held by many people. Some reject such a belief altogether, whereas others maintain an agnostic attitude toward it. Although most people would not consider the evidence presented by so-called "psychic phenomena" as sufficient to prove the existence of personal survival after death, a few outstanding thinkers, such as Sir Oliver Lodge and Sir Arthur Conan Doyle, not only believe much of the phenomena to be genuine but also evidential of spiritual survival. Some, who are convinced that many of the manifestations are genuine, do not accept as credible a spiritual explanation of what occurs.

Many arguments have been presented for and against a belief in immortality of the personality. Opponents of the belief have held that many who accept the theory have no other foundation for it than wishful thinking. Those who reject immortality also contend that since the personality is apparently contained within a physical body, when the body dies the personality must necessarily die with it. Some of the arguments presented in favor of the belief are: (1) the resurrection and teachings of Jesus; (2) since the righteous do not always get their rewards and the wicked do not always receive their punishments on earth, the belief in a just God requires that personality survive death; (3) a belief so long and so universally held is probably a correct belief; (4) personality is as basic as the elements and cannot therefore be destroyed; (5) matter and energy may be transformed but not destroyed; similarly personality may be translated from this world to the next but it cannot be destroyed; (6) the spirit is apparently independent of the body during dreams and therefore it could be independent of the body after death; (7) life is essentially incomplete on earth; the fulfillment of worthy desires necessitates an "afterlife." See HEAVEN; HELL; PSYCHICAL RESEARCH; SPIRITUALISM; TRANSMIGRATION.

W. G. D.

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**IMMORTELLE**. See EVERLASTING.

**IMMUNITY AND RESISTANCE TO DISEASE**. The human body is at all times exposed to germs, many of which would cause disease and death almost at once if it were not for the fact that the body possesses resistance or immunity to these noxious agents. Immunity, therefore, is defined as the power possessed by a living organism for resisting and overcoming infection. It is customary to divide immunity

into two main types, that which is natural and that which is acquired.

**Natural Immunity** is the resistance to infection possessed by individuals or species under normal natural conditions. For example, dogs are immune to typhoid, hogs to snake venom, and rats to diphtheria toxin; human beings are likewise resistant to a great many infections to which lower species of animals are susceptible. Within the human species some groups are more resistant to disease than others. Measles, for example, is a relatively mild disease for most city dwellers. When measles is introduced into a primitive society, however, it can cause terrible epidemics with a high percentage of deaths. Everyone knows also that some people are not attacked by certain diseases as readily as others. It is common to have several people exposed equally to an infectious disease, such as scarlet fever or whooping cough, with some catching the disease and others escaping entirely. This may be considered individual natural immunity.

**Active Acquired Immunity** is a type of resistance to infection brought into being by the activity of the person's own body or tissues. The living body possesses the power to respond to many infections by producing in the blood and tissues invisible substances called **ANTIBODIES**. Antibodies represent the principal power of the body to fight infection. When a person acquires such a disease as mumps or scarlet fever, for example, and the person recovers, antibodies are formed which enable the body to fight off further attacks of the same infection. Active acquired immunity or resistance can be artificially produced by giving vaccines to stimulate antibody formation in the tissues. Vaccines are usually germs that have been killed or weakened but still possess the power to stimulate antibody formation when they are injected. Among vaccines which are frequently used to produce active acquired immunity are those for smallpox, whooping cough, and typhoid. The vaccines against smallpox and diphtheria are not quite the same, though the effect in stimulating antibody production is similar. See **VACCINES AND SERUMS**.

**Passive Acquired Immunity** is defined as that form of resistance to infection caused by injecting antibodies built up in some other person or animal. In the natural form such antibodies may have passed from the mother to the offspring before birth or may have been formed by the mother and transmitted through the milk. Artificially produced passive immunity is present in what are usually called serums. Here the antibodies that possess the disease resistant qualities may have been formed in another person who had the same disease but who recovered. Serum obtained from such sources is called *convalescent immune serum*. It is also obtained from the active immunization of animals, such as horses, cattle, rabbits, or sheep, that have been given sufficient quantities of the germ or toxin to cause them to produce antibodies. When these animals have enough antibodies in their blood the serum can be removed and prepared for injection into human beings. When this is done the recipient has passive but usually temporary immunity to the disease in question. This is the type of treatment that has been used so extensively in the form of diphtheria antitoxin against diphtheria, and tetanus antitoxin against tetanus or lockjaw.

**Antibodies**. There are several kinds of antibodies. Some of them are called antitoxins and combine with the toxins or poisonous products of germ growth. In diphtheria, for example, the germs are usually spread widely through the tissues but when growing in the throat—their usual location—produce a soluble toxin that is carried in the blood all through the body. This toxin stimulates the body to produce an antitoxin, which combines with it and makes the toxin non-poisonous. Other types of antibodies include precipitins, which precipitate "foreign" proteins; agglutinins, which cause clumping of bacteria and

thus prevent their spread; lysins, which dissolve bacteria; and opsonins, which render bacteria more susceptible to engulfment by white blood corpuscles. See **ANTIBODIES AND ANTIGENS**.

It has long been known that antibodies are made up of the gamma globulin fraction of the blood, and that lymphocytes release gamma globulin and antibodies into the blood stream. It has been shown recently that ACTH and CORTISONE control this process by causing dissolution of lymphocytes and release of gamma globulins, including any antibodies which may have been produced during a previous exposure to an antigen. Secretion of these hormones is probably increased during infections so that antibodies are released.

**Leucocytes**. Besides the antibodies that circulate in the blood there are in the blood small cells called leucocytes, or white blood cells, which are also active against infections. The simplest way to explain the activity of leucocytes is to describe what happens to an infected scratch of the skin. When germs are carried below the skin the blood immediately rushes as many of the leucocytes as possible to that area. Here the leucocytes at once begin to destroy the infecting germs and a race is on between the ability of the leucocytes to do this and of the germs to grow and multiply. In such areas what we call pus usually forms; this is made up principally of white blood cells that have served their function of destroying germs and have then died. Leucocytes act in much the same way when microbes invade other parts of the body. This type of resistance is called *cellular immunity*. See **INFLAMMATION**.

**Susceptibility**. The aforementioned methods of combating infection are subject to a great deal of variation, depending on the species, the age, the type of infecting germs, and in some cases even on what is called the condition of the individual. By this is meant that a person who is run-down and below par physically is often more susceptible to such infections as colds or pneumonia than is someone in more satisfactory health. See **COMMUNICABLE DISEASES**.

Every infectious disease represents a struggle between two forces, on the one hand the resistance of the host and, on the other, the invasiveness of the infecting organism or agent. Each of these is modified by the particular conditions under which the battle occurs. The subject of immunity and resistance, therefore, is concerned with the varying powers which the host possesses in resisting infection and in overcoming those which succeed in passing the initial barriers.

EDWIN P. JORDAN, M.D.

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**IMOLA**, town and episcopal see, N Italy, Emilia Division, Bologna Province, on the Santerno River; 21 miles SE of Bologna. It has mineral springs. Interesting features of the town include a 12th century cathedral, a citadel with round towers, the churches of Sant' Agostino and Santa Maria delle Grazie, a library containing rare manuscripts, and several ancient palaces. There is an agricultural college. Industries include spinning mills; glass, majolica and earthenware pottery works; brick and tile kilns; gunpowder factories; and manufactures of soap, silk textiles, and leather goods. Vegetables are grown for market. Impala was the Roman *Forum Cornelii* on the Aemilian Way. After being held by various chiefs during the Middle Ages, it was incorporated into the States of the Church under Julius II in 1500. During World War II the town suffered slight damage when captured by the Allies in 1945. Pop. (1948) 41,525.

**IMPALA**, or **PALLAH**, a reddish-brown ANTELOPE found in the bush country of eastern and southern Africa. Impalas, *Aepyceros melampus*, are especially graceful and swift. They haunt water courses in the neighborhood of thick scrub, to which they retire in

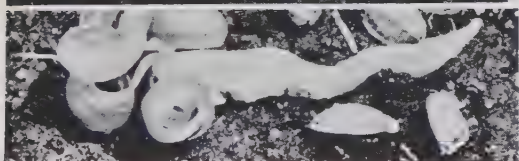
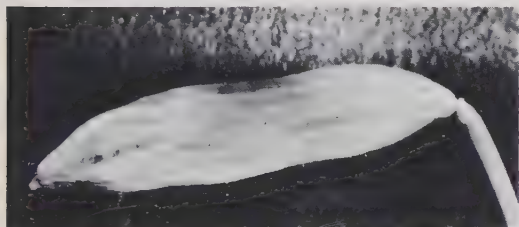


case of danger. The bucks, averaging 36 inches in height at the shoulder and 140 pounds in weight, are distinguished by large, gracefully curved horns. Their numbers have been greatly reduced by the attacks of lions and leopards, as well as by hunters.

**IMPATIENS, Common Garden Balsam, or Touch-Me-Not, *Impatiens Balsamina*,** is a member of the family *Balsaminaceae*. It is native to the tropics and subtropics of India, from where it was introduced into cultivation. This small, somewhat succulent herb has thin light green leaves and showy rose colored, red, yellowish, white, or spotted flowers.



L. W. BROWNELL

Snapweed (*Impatiens capensis*)

LYNWOOD M. CHACE PHOTOS

Snapweed Seed Pod, upper photo, throws seeds some distance by the springs shown in lower photo

It is an annual and is commonly cultivated in gardens. The seed pods, as in the snapweed *I. capensis*, and other members of the genus, explode or collapse when touched or upon reaching maturity and eject the seeds with considerable force. J. A. STEYERMARK

**IMPEACHMENT.** In the United States, the term is usually restricted to the constitutional process for the removal from office of an official of the government by the concurrent action of the two houses of Congress or of a state legislature. The Federal Constitution vests the sole power of impeachment of the president or other officer of the national government in the House of Representatives, and the sole power of trying such impeachments in the Senate.

The offenses which render an officer liable to impeachment are treason, bribery, and other high crimes and misdemeanors. This has been defined to include any violation of the Constitution and laws which is of such a character as to render the culprit unfit to hold office under the government. The penalty in case of impeachment is limited to removal from office and disqualification to hold any office of trust, honor, or profit under the government. If the offense for which impeachment has been had involves a violation of the criminal law, the offender may also be prosecuted in the ordinary tribunals.

**Procedure.** The procedure of impeachment in Federal cases is for the House of Representatives by

resolution to direct the impeachment of the accused officer, and to appoint a committee to formulate the charges in a series of articles of impeachment, which, after approval by the House, are formally presented to the Senate by a committee of the House appointed to prosecute the impeachment. The Senate thereupon issues process, summoning the accused to appear at the bar of the Senate and plead to the articles of impeachment. The Senate then resolves itself into a Court of Impeachment; and, after hearing the plea of the accused official, on the day set for the trial sits as a court of justice and proceeds to try the defendant on the charges formulated by the House. The Impeachment Committee of the House conducts the prosecution, the defendant being allowed counsel to conduct his defense. The Senate votes by "yea" and "nay" on each article of the impeachment, a two-thirds vote being necessary to secure conviction on any charge. On the impeachment of the president of the United States the chief justice of the Supreme Court presides over the Court of Impeachment. The procedure of impeachment in the several states is substantially like that which obtains in Congress.

**History.** The House of Representatives has voted impeachment proceedings against 13 Federal officials—one president, one cabinet official, one senator, and 10 judges. The following have been convicted: John Pickering, judge of the U.S. District Court, convicted in 1803 for drunkenness and profanity on the bench and for unlawful decisions; West W. Humphreys removed from the District Court in 1862 for giving support to the Confederacy; Robert W. Archbald, judge of the U.S. Commerce Court, removed in 1913 for entering into a corrupt alliance with coal mine owners and railroad officials; Halsted L. Ritter, removed from the District Court in 1936 for corrupt dealing with a receiver in bankruptcy. Besides these four convictions seven cases resulted in acquittals, while in the other two cases, one was ended by resignation before trial and one was dropped without trial. The most famous impeachment was that of President ANDREW JOHNSON in 1868, who won acquittal by a single vote in the Senate; the charges against him were political, involving reconstruction policy after the Civil War. Impeachment is most frequently used against judges who hold office during good behavior and can be removed in no other way.

**States.** In the states impeachment has been less used because most officials hold their positions for brief terms. In addition, some of the states have the recall which they may use against public officials. The most prominent impeachments in recent years were the following: Governor William Sulzer, of New York, removed in 1913 on the broad grounds of unfitness, but probably because of his defiance of Tammany Hall; Governor James F. Ferguson of Texas, removed in 1917 for alleged misappropriation of public funds; Governor J. C. Walton of Oklahoma, removed in 1924 for alleged misappropriation of public funds, but actually because he called out troops to curb the Ku Klux Klan; and Governor Henry S. Johnston of Oklahoma, removed in 1929 for general incompetence. In practice, most of the state impeachments have been based on partisanship.

**Other Uses.** In English law impeachment is the prosecution of a commoner or a peer of the realm by the House of Commons at the bar of the House of Lords for treason or crime.

The term impeachment is also employed in the law of evidence to describe the allegation, which must be supported by proof, that a witness who has testified in open court is unworthy of credit; and in the law of real property in the phrase "impeachment of waste" to indicate the liability of a tenant for life or years for waste committed in the premises. See EVIDENCE; HASTINGS, WARREN. F. M.

**IMPERIA, formerly Porto Maurizio,** small province of NW Italy, Liguria Division, bounded on the N by Cuneo Province, E by Genoa Province, S by the

Ligurian Sea, W by France; area 467 sq. mi.; pop. (1954 est.) 173,000. It is mountainous throughout, traversed by the Ligurian Alps. The chief rivers are the Neva, Arroscia, and Roja. There are orchards, vineyards, and extensive olive groves. Fruits, wines, and olive oil, and fresh, cut flowers are exported. The principal cities are Imperia, the capital, Ventimiglia, Onegha, Albenga, and San Remo, all of which are seaports.

**IMPERIA**, or **Porto Maurizio**, city and seaport, NW Italy, Liguria Division, capital of Imperia Province; 46 miles E of Nice and 70 miles SW of Genoa. It is picturesquely situated on a promontory, surrounded by dense olive groves, and is a popular winter resort. Its domed church was built in 1780. It has a well-sheltered harbor and a brisk trade in olives, olive oil, and wines. Pop. (1954) 26,400.

**IMPERIAL MOTH**, *Basilona imperialis*, one of the largest of the North American moths, measuring 4 to 6 inches from tip to tip of the wings. It is yellow with brown speckles, and has on each wing an "eyespot" and a diagonal brown line.

**IMPERIAL VALLEY**, S California and N Lower California, a fertile area reclaimed from the Colorado Desert by irrigation and used extensively for large-scale production of garden crops. Most of the valley is below sea level. The rainfall is low, and extreme changes of temperature occur within short periods. Irrigation of the valley was considered first in 1876, and after water was diverted from the Colorado River in 1901, settlers began to come into the area. The irrigation system was greatly hindered by repeated floods of the river, especially from 1905 to 1907 when the level of the SALTON SEA was raised. The floods finally were brought under control by the building of HOOVER (Boulder) DAM, opened in 1938. About 500,000 acres have been irrigated and the rich land produces great quantities of early vegetables and fruits, particularly citrus, for eastern markets. The principal cities of the valley are BRAWLEY, CALEXICO, EL CENTRO, Holtville, and Imperial. See RECLAMATION.

**IMPERIALISM**, the policy of national expansion either by annexation or by gaining possession of colonies, dependencies, and protectorates. The most important motives for imperialism include the struggle for strategic areas and bases; the desire to establish an imperial economy; the desire to find an outlet for surplus capital; the search for raw materials and markets; the hope to find an outlet for surplus population; the desire for political prestige. The methods of imperialism have varied from military conquest and outright occupation to obtaining trading concessions. In some cases, spheres of influence have been established; in others, trading privileges have been extorted from native rulers; and in still others, native rulers have been persuaded to accept the "protection" of a great power.

Political imperialism aims to achieve political control over an alien people through the creation of a puppet government, through the establishment of a protectorate, through annexation, or through the creation of a colonial government. The possession of such key positions as the Suez Canal, the Gibraltar, Hong Kong, the Panama Canal, and the Baghdad Railway has been the main objective of military imperialism. The aim of cultural imperialism is the conquest and control of the minds of men, and is often employed as a subsidiary to political, economic, and military imperialism. In recent history the imperialism of Nazi Germany and of the Soviet Union offers examples of highly organized and successful cultural imperialism. The aims of economic imperialism are the utilization of backward regions for the investment of surplus capital, the exploitation of raw materials and mineral deposits, and the creation of markets for the products of the mother country. British "oil imperialism" in the Arab lands and American "dollar diplomacy" in

South America are examples of economic imperialism.

The objectives of imperialism may be the domination of the entire world. Recent examples of such imperialism are those of Hitler and Stalin. Contiguous imperialism is directed against neighboring peoples. The policies of the French kings are examples of such imperialism. Overseas conquest involves the establishment of colonies; European powers which successfully invaded distant militarily weak nations, and conquered them, pursued such a policy of colonialism. Imperialism may also be limited in its objectives to localized aims; the prototype of this kind of imperialism can be found in the monarchical policies of the 18th and 19th centuries. Imperialism can be destructive; it can seek to expel or exterminate the conquered peoples. Nazi imperialism was of this kind. Imperialism can insist on keeping apart the various peoples who compose an empire or can attempt to assimilate them. It can either force or persuade the subject peoples to adopt the ways of the conquerors. Soviet despotism has pursued this policy. Tolerant and co-ordinating imperialism respects and preserves the particular features of alien nationalities.

Imperialism is as old as mankind. In recent decades many nations have pursued imperialistic policies. Particularly aggressive have been the imperialistic policies of Fascist Italy, Nazi Germany, and totalitarian Japan. The period following World War II witnessed the full development of the imperialism of the Soviet Union. Soviet imperialism is based on the revolutionary doctrine of COMMUNISM which has universal dimensions and aspires to universal control. See BRITISH COMMONWEALTH OF NATIONS; COLONIAL SYSTEM; EMPIRE; FASCISM; NATIONAL SOCIALISM; NATIONALISM; POWER POLITICS; WAR.

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**IMPETIGO CONTAGIOSA** is a superficial, highly contagious skin eruption due to infection with a variety of staphylococcus germs. The infection is usually spread among persons in closely crowded quarters such as factories, schools, and the poorer types of housing facilities. Epidemics among children often run through schools and are very difficult to control. The infection is spread by personal contact, usually on the hands.

The disease can be successfully treated by lotions or ointments containing sulfathiazole or aureomycin. Transference of the disease from one person to another can best be prevented by careful washing of the hands, and by avoiding contact with infected individuals.

**IMPHAL**, town, India, Assam Province, capital of the former feudatory state of Manipur, on the Manipur River, 70 miles E of the rail station of Silchar. The town is situated in a marshy valley completely closed in by mountains and is a highway junction for roads leading to northern Assam, Burma, and Bengal. Modern POLO was revived here and taken to India in 1863, and the near-by countryside is a favorite haunt for pheasant hunters. During World War II, Japanese forces drove upon Imphal from the north and east in an effort to cut the railway that carried supplies to Ledo, the terminus of the Assam-Bengal railway and the start of the flight "over the hump" to China. They succeeded in reaching Kohima, 10 miles north, before being forced to retire.

**IMPLEMENTATIONS AND MACHINERY, AGRICULTURAL.** See FARM MACHINERY.

**IMPLIED POWERS**, the doctrine that the enumerated powers of the Federal CONSTITUTION should be broadly interpreted to give the Federal government extensive powers. Under the federal state system of government provided for by the Constitution (see



FEDERAL STATE) all powers that are "not delegated to the United States by the Constitution nor prohibited by it to the states, are reserved to the states respectively, or to the people." (Tenth Amendment). The powers of the Federal government are mainly enumerated in the eighth section of Article I of the Constitution, some 25 powers being listed in 17 clauses, following which is a provision granting Congress power "to make all laws which shall be necessary and proper for carrying into execution the foregoing powers . . ." In the early years under the new government there was great controversy on the matter of broad or restricted construction of this clause. ALEXANDER HAMILTON, the leader of the broad constructionists, known as the Federalists, argued that the restrictive words in the clause—"necessary and proper"—should be loosely defined as *needful* or *useful*. THOMAS JEFFERSON, leader of the Republicans, wanted to place emphasis on the word "necessary"; he believed the powers granted by the clause were only those absolutely necessary for carrying out the preceding powers. Jefferson contended that Hamilton's loose construction would lead to a tremendous expansion of the Federal government. Actually, the Federalists were anxious to establish a strong central government, while the Republicans were more concerned about STATES' RIGHTS and the liberties of the people. See FEDERALIST PARTY.

Yet when Jefferson became president he made some use of implied powers, although with a troubled conscience. Meanwhile JOHN MARSHALL, a strong Federalist, gave his judicial backing to the doctrine of implied powers as chief justice of the Supreme Court. In 1819 in the famous case of *McCulloch v. Maryland*, Marshall stated his position as follows: "Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consist with the letter and spirit of the Constitution, are constitutional." Through the use of implied powers the Constitution has been developed so that with a minimum of amendments it serves an industrial, urban, 20th-century population of 140,000,000, although originally it was drawn up for the needs of 4,000,000 18th-century farmers. Pure-food laws, antilobby legislation, trust regulation, and antikidnaping laws are but four Federal activities based on the doctrine of implied powers. See SUPREME COURT OF THE UNITED STATES; JUDICIAL REVIEW. FRANK L. ESTERQUEST

**IMPORTS AND EXPORTS.** See TRADE AND COMMERCE.

**IMPRESSIONISM.** In art, impressionism is a technique for recreating the visual appearance of objects on canvas. Although impressionism did not become a concentrated art movement until late in the 19th century, it had its beginnings in the Renaissance experiments of Leonardo da Vinci and was actually practiced by Titian, Velázquez, and Goya. In the search for absolute surface naturalism instigated by Courbet and Manet, a group of Frenchmen in the 1870's utilized the new scientific analyses of color to record nature truthfully. Their leader, CLAUDE MONET, believed subject matter unimportant but its appearance under light paramount, since it is not the object itself but an impression of the object that the eye sees. Thus it was thought that true realism could be achieved through the study of light. See MODERN ART.

Monet had been influenced by the Spanish painters through the work of ÉDOUARD MANET, and had also studied the sparkling light in the paintings of Constable and the use of color in those of Turner. He and the other members of the Impressionist group, notably Camille Pissarro, Alfred Sisley, Pierre Auguste Renoir, and Berthe Morisot, painted their canvases in broken color. Called divisionism, this use of broken color meant the juxtaposition of primary colors which would be blended by the eye at a distance. Color,



ART INSTITUTE OF CHICAGO

"Lady at the Piano," by impressionist Renoir

the keynote of impressionism, was interjected into all parts of painting. Even shadows, considered by previous artists to be black, were found to contain mixtures of many colors.

Landscape was the chief subject matter of the Impressionists, for it lent itself most easily to the study of the surface play of light over nature. It was Monet's landscape "Impression: soleil levant," which was shown in the Salon des Refusés of 1874, that inspired the use of the term impressionism.

Musical impressionism gained its name from impressionistic painting and was similar to it in its attempt to suggest a fleeting image. However, it was more exactly concerned with duplicating the emotion connected with the image. To achieve its effect such music utilized the whole-tone scale, unresolved dissonances, parallel or gliding chords, and irregular or fragmentary phrasing. These technical mannerisms produced a dreamy, vague, musical effect. DEBUSSY's *L'après-midi d'un faune* was the first composition in the impressionistic style and Debussy himself is the acknowledged leader of the school. Other musicians who have utilized the impressionistic technique are Ravel, Dukas, Florent Schmitt, Roussel, and de Séverac.

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**IMPRESSMENT**, an irregular method of drafting men into the army and navy formerly employed by states as an exercise of their sovereignty. All European states have employed this method, but since the beginning of the 19th century it has been supplanted by conscription. Impressment was used regularly in Great Britain for several centuries before it was abandoned as inconsistent with the rising democracy. During the reign of Elizabeth justices of the peace were required to furnish a specified number of able-bodied men for the navy. During the Civil War both Charles I and Parliament resorted to impressment to fill their armies. The method, however, was more commonly used for the navy. Naval officers bearing press warrants issued by the Admiralty would forcibly seize able-bodied men on the streets and in the

taverns. In time of emergency all able-bodied men between 18 and 55 were subject to impressment but certain classes were exempted. In practice, the men recruited by this method were the lowest classes of the population—vagabonds, paupers, and criminals. The use of such men in the armed services created many problems for the commanders; moreover, it tended to discourage voluntary enlistments. Yet it was continued out of necessity. In 1776 and 1779, because of the difficulty of obtaining enlistments for service during the American Revolution, press gangs rounded up rogues and vagabonds for the army and navy. By 1800 the British army had abandoned impressment, partly because of rising public sentiment against it, partly because impressed men had been found mutinous, disloyal, and even dangerous. The navy continued to make use of press gangs throughout the Napoleonic wars. Sometimes merchant vessels arriving in port would be boarded and most of the crew would be carried off for service on warships. Since many British sailors had entered into the service of American ships and also since Great Britain did not recognize foreign naturalization without consent of the crown, one practice was to board American vessels so that men of British nationality might be taken off. Many naturalized Americans and even native Americans were thus impressed. One estimate places the number of naturalized and native Americans impressed at slightly under 10,000. The incident most humiliating to the United States was the boarding of the *CHESAPEAKE* in 1807 and the removal therefrom of several "deserters." President Madison in his war message of June 1, 1812, gave impressment as the principal reason for going to war. Yet the Treaty of Ghent, which brought the WAR of 1812 to an end, made no mention of impressment. Great Britain thereafter relied on voluntary enlistments in the armed forces until the beginning of World War I when conscription on a nationwide basis was instituted. See CONSCRIPTION.

**IMPRISONMENT.** See PRISON; PUNISHMENT; CRIME, *Classification of Crime*.

**IMROZ**, or **Imbros**, Turkish island in the Aegean Sea, SE of Samothrākē (Samothrace) located near the entrance to the Dardanelles and included in the Canakkale Vilayet; area about 88 sq. mi.; pop. (1945) 6,337. Extensive formations of andesite and sandstone occur on the island. Its topography is characterized by hills and woods in the north, fertile plains in other areas. Fishing is the most important industry, although there is also cultivation of fruit, grains, and olives. The chief town is Kastron (Castro). Imbros was occupied by the Greeks during the Balkan Wars (1912–13) and by the British during the Gallipoli campaign of World War I. Although promised to the Greeks, it was awarded to Turkey in 1923 by the Treaty of Lausanne and demilitarized.

**INACCESSIBLE ISLAND.** See TRISTAN DA CUNHA.

**INAJA PALM**, a South American palm over 100 feet high, with leaves from 30 to 50 feet long. These are pinnate and drooping, and their fibers are used by the natives for cordage, etc. From the fruit, which has a soft pulp and hard skin, monkeys find sustenance, and Amazonian Indians make a kind of flour which they use for seasoning. The spathes are used by the Indians as cradles and by hunters as cooking utensils. The undeveloped leaves are used as a kind of vegetable.

**INARI, LAKE**, Swedish **Enare**, large fresh-water basin, N Finland; area 549 sq. mi. It drains to the Barents Sea by the Pasvik River.

**INAUGURATION, PRESIDENTIAL**, the state ceremony in which the President of the United States is inducted into office. Under the Twentieth Amendment to the Constitution (Lame Duck Amendment), adopted late in 1933, the inaugural ceremony takes place on January 20 following the presidential election. The terms of both President and Vice-President

commence on that date. Franklin D. Roosevelt was the first U.S. president to be inaugurated on the new date instead of on the traditional March 4.

**INBREEDING.** See BREEDING.

**INCA**, an Indian of the tribes inhabiting the highlands of Peru, predominant in South America at the time of the Spanish conquest. *Inca* originally was the name of the governing family or the monarch himself, but in later times it came to embrace the whole group. When the Incan empire was at its height at the end of the fifteenth century, it extended some 3,000 miles from Colombia to central Chile, and eastward across the Andes into the western Amazon basin. The seat of civilization of the Incas and their predecessors, the Aymarás (see *AYMARÁ*), was between the eastern and central mountain ranges of Peru. The ancient capital was at Cuzco (see *Cuzco*).

The Inca tradition of origin holds that at some distant time there came from the Valley of Pilcamayu, to the south of Cuzco, four brothers with their four sisters, who advanced northward toward Cuzco. Three of the brothers and three of the sisters were not allowed to reach their destination, but the surviving brother, Manco Capac, with his remaining sister, Mama Ocllo Huaco, whom he married, arrived at Cuzco about 1240 or 1250. Immediate successors of Manco Capac extended his empire north and south from Cuzco. By the time of Pachacutec, who reigned c.1400–48, the empire included most of the coastlands and highlands of modern Peru and part of Argentina. During the reigns of Tupac Yupanqui, from c.1448 to c.1482, and Huaina Capac (see *HUAINA CAPAC*), from c.1482 to 1525, the empire was enlarged to include what are now Ecuador and northern Chile, as well as more of northwestern Argentina. Inca Huaina Capac divided the lands between his two sons, Atahualpa and Huascar (see *ATAHUALPA*; *HUASCAR*). After the death of their father, the half brothers fell to fighting, and by the time Gonzalo Pizarro (see *PIZARRO*, *GONZALO*) invaded the empire in 1532, Atahualpa had defeated and imprisoned Huascar. Atahualpa was captured by Pizarro, held for a ransom of gold, and killed shortly after the ransom was collected. The Spaniards thus brought to an end the Inca empire, although for some time afterward various groups of Indians in scattered areas opposed the invaders.

The Incas were noted for their extensive road system and for the use of massive stone blocks in the construction of public buildings. They cultivated a variety of crops, building aqueducts for irrigation, terracing steep hillsides, and using guano and fish for fertilizer. Superstition and ancestor worship entered into their religion, but all worship was subordinate to the worship of the creator of the universe, the supreme deity. The Incas had a calendar, and although their language was rich and expressive they had no writing. There were poets, dramatists, and musicians, and the people had some knowledge of geography, astronomy, and surgery. See *PERU*, *People*.

**INCANDESCENT LIGHT.** See *GAS ILLUMINATION*; *GAS MANTLE*; *ILLUMINATION*; *LAMP*, *ELECTRIC*.

**INCANTATION**, a set form of words, sung, intoned, or spoken, in the belief that it produces a supernatural effect. Among ancient peoples practically all the events of human life were attended by incantations. They were used to banish evil spirits, to summon good ones, to bring or keep away rain, to heal the sick, to bring success in war and love. They consist usually of a prescribed formula, often kept secret, involving the following elements: (1) sacred or powerful names; (2) invocations, threats, or entreaties; (3) expressions of the commands, wishes, or intentions of the offerer; (4) sacred narratives of events similar to those it is desired to effect.

Although an incantation is essentially a sacred formula, the word has often been disparagingly employed and has become associated with suspicious if not actually evil designs. Gower, in 1390, refers to incantation as the characteristic method followed in



necromancy. The medieval Gaelic monks applied the terms *incantators* and *magi* to the pagan priests who opposed St. Patrick and St. Columba.

At the present day, incantations against diseases or other evils, and for guidance in the affairs of love, are frequently practiced among primitive peoples. See MAGIC.

**INCARNATE WORD COLLEGE.** See COLLEGES.

**INCARNATION**, the act of a supernatural being assuming human flesh. The term found use in various Greek religions, in which human bodies were considered to be used by gods as a temporary means of communication with mankind. Its most widely accepted belief, however, is in Christianity. Christian theology teaches that God assumed the form of man in the person of JESUS CHRIST, becoming wholly human in all things except the inclination to evil, while remaining wholly divine. This is the general acceptance of the meaning of the Apostle John's words "And the Word was made flesh, and dwelt among us." (John 1:14.)

**INCE-IN-MAKERSFIELD**, urban district, England, in Lancashire, adjoining the borough of Wigan, on the Leeds-Liverpool Canal. Its industries are collieries, iron works and forges, and cotton mills. Its Old Hall, with its timbered arches, is a fine architectural example. Pop. (1950 est.) 23,500.

**INCENDIARISM.** See ARSON.

**INCENSE**, an aromatic substance giving off a pleasant odor during combustion, used in divine service. The Oriental fondness for strong perfumes, attributed also to the gods, is the probable basis of the common use in the Orient of incense in worship. The Babylonian epic, of unknown antiquity (5000 B.C.), makes the hero of the flood story offer incense on coming out of the Ark. Its use by ancient Egyptians and Greeks is well known. The Hebrew code (Exod. 30:34-36; Lev. 16:12-13) prescribed its use; and it is favorably mentioned in the New Testament (Rev. 5, 8; 8, 3; cf. Matt. 2; 11).

In the Roman church incense is used in the solemn (or high) mass, in the consecration of churches, in solemn consecrations of objects intended for use in public worship, and at the burial of the dead. There are also minor incensations of ministrants, and a general incensation of the congregation.

In the Anglican church the use of incense is permitted, but not as a ceremonial part of the service.

The incense at present in use consists of some resinous base. The ingredients are usually olibanum, benzoin, styrax, and powdered cascarilla bark. These are so placed in the censer as to be sprinkled by falling on a hot plate, which immediately volatilizes them, and diffuses their odor. See FRANKINCENSE.

**INCENSE CEDAR**, a handsome medium-sized to tall tree, sometimes attaining a height of 186 feet and a diameter of 8 feet, belonging to the genus *Libocedrus*. Distribution of the incense cedar, *L. decurrens*, in North America is limited to Oregon, Nevada, and California. The tree grows singly and in groves, thriving best in central California at elevations of 5,000 to 7,000 feet. It has bright green scalelike leaves that occur in flattened sprays, affording a superficial resemblance to the arbor vitae, and bark that is cinnamon-red, irregularly ridged, and scaly. The bole

tapers rapidly, giving the tree a pyramidal appearance. Although soft, the wood is durable, easily worked, and fine in texture. It is used locally for poles, posts, in the construction of buildings, and as a substitute for juniper in the manufacture of lead pencils.

**INCEST**, carnal intercourse between a man and woman who are by reason of their relationship forbidden to intermarry. From a very early period it has been under the ban of the church and in early European history it was punishable by the civil courts as well. In England, incest was at one time a capital offense, but the punishment of it was afterward left to the spiritual courts, and for some time it was not a crime. The Punishment of Incest Act (1908) made carnal knowledge of a man's mother, sister, daughter, or granddaughter, whether legitimate or illegitimate, a misdemeanor.

In the United States, incest is a punishable crime; but the degrees within which marriage is permissible are regulated by the statutes of the various states. See CONSANGUINITY; MARRIAGE.

**INCH**, a unit of measure that is a twelfth part of a foot. The common divisions of an inch are halves, quarters, eighths, and sixteenths; micrometer measurements divide an inch into hundredths, thousandths, and ten-thousandths. An inch equals 2.54 centimeters. In ancient Rome the inch was divided into twelfths. See WEIGHTS AND MEASURES.

**INCHCAPE ROCK.** See BELL ROCK.

**INCHCOLM**, a small island, E central Scotland, Fifeshire, lying in the Firth of Forth, 2 miles S of Aberdour, NW of Leith. The Augustinian monastery of Inchcolm was founded by Alexander I in 1123. It is referred to in *Macbeth* as St. Colme's Inch.

**INCHKEITH**, a rocky isle, E central Scotland, Fifeshire, lying in the Firth of Forth; 3 miles S of Kinghorn, opposite Leith. The lighthouse, which has a revolving beacon, rises 220 feet above sea level. There are ruins of a monastery founded in 700.

**INCHON**, or Chemulpo, also Jinsen, city and port on the Yellow Sea, W central Korea, in the South Korean province of Kyonggi, 18 miles WSW of Seoul. It was opened to foreign trade in 1883 and became an important port and industrial center. Japanese forces captured the city in 1904. United Nations forces under General MacArthur landed at Inchon in 1950 during the war in Korea. Pop. (1949) 265,767.

**INCLINED PLANE**, a continuous surface rising at an angle to the horizontal. In physics, the term "machine" includes the practical adaptation of the inclined plane, as in the case of ramps, gangplanks, etc. Depending upon the angle of inclination, it requires a lesser effort to move an object up such a surface than to lift it vertically. Theoretically, one pound of effort is needed to move a weight of five pounds up a frictionless inclined plane 20 feet long with a 4-foot rise.

A common application of the inclined plane is the screw which is, in helix form, a plane following the exterior of a cylinder. A wedge is a double inclined plane; cutting tools of nearly all types are wedges. The cam and toggle joint also make use of the principle of the inclined plane. See MECHANICS.

**INCLINOMETER**, incline+meter, the name given a group of instruments designed to measure the degrees of inclination. One type of inclinometer is used to determine the direction of the earth's magnetic force with relation to the plane of the horizon. The apparatus consists of a dip needle with its accessories. It is also called a dipping compass or dip circle.

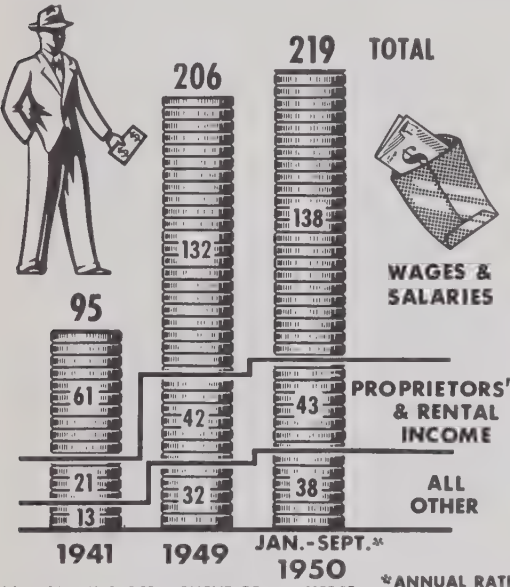
**INCOME**, in economics, may be defined as the pecuniary valuation of the flow of goods and services which have as their function the satisfaction of human wants. In its strictest meaning, the notion of income does not imply a monetary valuation; thus in a barter economy income refers directly to the goods and services produced by the individual or received by



U. OF CALIFORNIA

Incense cedar

him in EXCHANGE. Similarly, in modern times, the possibility of transforming nominal income (money) into real income (services and goods) is a basic assumption. However, in a free exchange system in which money is both the medium and the common denominator of all economic transactions, it has become customary to describe income in terms of its pecuniary rather than its ultimate value. For example, A and B may each receive an income of \$5,000. A purchases a diamond ring with his money while B supports his family of five with his for a year. Thus the real satisfaction of the incomes may be quite different to A and B, but it is of practical value to designate



Personal income in the U.S. in billions

their incomes as being equal. Such a description is of more use in contemporary society because the pecuniary valuation is primarily an objective measure and it is comparable to related economic phenomena such as cost of living, expense, receipt, revenue, etc.; and, as such, can be related to the whole demand and supply mechanism of a free exchange economy.

The most striking innovations in the modern concept of income lie in a marked stress upon the importance of the ideas of "services" and of "flow." Thus income arises from, or has its source in, productive services and the most spectacular feature is the circularity of the flow of these services on the free market. In a free exchange economy, resources are largely owned by private persons for the sole purpose of deriving income from the sale of the services of these resources. That is to say, first a productive service may be yielded by a durable as well as a non-durable good; and, secondly, the services rendered by the goods are the economically significant factor rather than the goods themselves, i.e., a human being sells his services and not himself in the market.

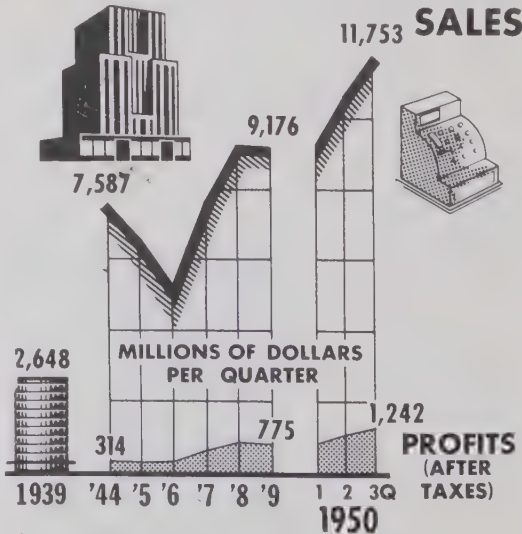
The concept of a circular flow of income is one of the more obvious facts which, in so being, is commonly overlooked. The entrepreneur buys or leases the services of a resource for which he pays money. For example, he hires (leases) the services of laborers; buys a machine in order to avail himself of its services—the machine itself remaining idle would be of no use to him; borrows (leases) money at interest so that he may avail himself of its purchasing power, which is its service. On the one hand the money which he pays for these services is entrepreneurial cost, but, on the

other hand, this same money is *income* to the laborer who receives it for his services, to the manufacturer who sold the machine, to the banker who loaned the money. Thus the important economic element in the process is the circularity of the flow and the interdependence of all transactions. Thus what is cost to the promoter is income to the owner of resources and vice versa.

The implications of the flow of income to both individuals and society are clear. In both cases, the import is more pressing when real income (services available for direct consumption) decreases. For society, however, there are, at least, three additional considerations: First of all, there is the question of distribution. Within the framework of a capitalistic society, the share of income accruable to each individual is quite obviously dependent upon the extent of his ownership of productive services at any time plus their respective valuations in the market. It is, then, for society to either accept, reject, or modify the given distribution (according to its policy) in the most effective manner. The media in any case are liable to be fiscal measures, that is, taxation.

Secondly, there is the problem of the level of flow. Although the income—whether social or individual—is eventually dependent upon services, the monetary valuation may be at different levels. This may be due to inflationary or deflationary spiral in the economy. If so, a rising or falling level is not necessarily a reflection of prosperity or recession. On the other hand, a rising or falling level may not be strictly attributable to "monetary" factors. The total services available for immediate consumption may have increased; and, in this case, increased monetary income—from the point of view of society—is certainly an index of prosperity, of a "higher level of production."

The third consideration involves the relation of saving and capital formation to income; and concerning this issue, there is much historical and contemporary discussion. ADAM SMITH distinguished gross income from net income (which allowed for maintenance and replacement of the resource). The late 19th-century economist, Alfred Marshall made a similar distinction, maintaining that since net income refers to that which will be consumed directly,



Sales and Profits of 200 manufacturing corporations with assets of over 10 million dollars

it may not properly include dividends or those funds reinvested. In keeping with this rather consistent tradition, modern usage generally excludes the capitalization of any future gain from the calculation of



"actual" income and some modern economists hold that neither for the individual or for society as a whole can any funds or production be deemed income which are used to maintain or replace capital goods or resources.

Although much of such theory and discussion may appear at first of little value, practical economics make much use of such concepts in the fields of accounting and taxation where sharp distinctions between income and capital are frequently difficult to determine. See NATIONAL INCOME; INVESTMENT; BUSINESS CYCLE; CAPITAL; CONSUMERS' GOODS.

M. SHEPHERD

INCOME, NATIONAL. See NATIONAL INCOME.

## INCOME TAX

### Main Source of National Revenue

*Income tax superseded property tax as commerce became more important than land*

**INCOME TAX**, a tax levied on net income by national, state, communal, or municipal governments. Wide variations in definitions of taxable income, rates and methods of administration exist, however. Income taxes may be proportional—i.e., levied at a fixed percentage, regardless of the size of the income; or graduated—i.e., levied at rates varying according to the size of the income. Graduated taxes are usually progressive, increasing as the income increases. An income tax is said to be differentiated or "classified" when the rates vary according to the kinds as well as the amounts of income. Thus, funded income, in the sense of income from bonds or real property (so-called "unearned" income) is sometimes distinguished from salary or other income from personal service ("earned" income). Certain abatements or deductions are customary, which, if decreasing as the income increases, have the effect of introducing the progressive feature in a tax otherwise proportional, or of increasing the progression in a tax already graduated. In general, total exemption is granted on the smallest incomes. Furthermore, nations pursuing populationist policies usually levy heavier income taxes on bachelors than on married persons.

Double taxation and taxation without jurisdiction are evils inherent in income taxation. The basic principles of income taxation are 4 (Seligman's *Income Tax*): (1) income means the total income, less expense of acquiring it; (2) it must be measured over a period of time; (3) its use must leave capital unimpaired; (4) it includes money income and profits which are easily computed as money value. The courts are in agreement that the legislature may tax, as income, capital net gain, meaning gain resulting from the sale, exchange or disposition of property, other than gifts.

In England the earliest tax was an adjunct to the land tax imposed by the act of 1692. The tax was small and yielded so little that it fell into disuse. The financial necessities occasioned by Napoleon's wars, however, led to the imposition of a regular income tax in 1799, introduced by the celebrated statesman, William Pitt, the younger. This was repealed for a short time after the Treaty of Amiens (1802), but with the resumption of war, a new one was enacted in 1803. After Waterloo, the income tax was again repealed, to be revived in 1842 in order to discontinue tariffs, other taxes on commodities and license taxes, and thus bolster the free trade policy. Since that time it has been assessed without interruption; and while originally intended as a temporary expedient, and voted annually in that form, it is in reality a permanent part of the English fiscal system. As a regulating device to balance receipts and expenditures, its rate is fixed annually by Parliament. Since 1907 it has been so modified by abatements and the

supertax (additional on incomes above a specified sum), as well as by decreasing rates on earned incomes, that it is in effect progressive. In 1910 a supertax was first assessed. The amount of income exempt from the supertax was fixed at £2,000 in 1918, £3,000 in 1919, £2,500 in 1920, £2,000 again in 1921 and was £2,000 in 1933–34. At the outbreak of World War I, the general rate of the income tax was 1s. 6d.; by the end of the war, 6s. in the pound (30 per cent), and the supertax, 4s. 6d. (22.5 per cent), making a nominal rate on the largest incomes of 52.5 per cent. This was reduced until in 1927–8 the standard rate was 4s. in the pound and the maximum supertax rate 6s., making a total nominal rate of 10s., or 50 per cent on the largest incomes. In 1937–38 the standard rate was 5s. in the pound, subject (for individuals only) to specific allowances. The standard rate was changed, by the war budget of Sept. 27, 1939, to 7s. 6d. in the pound, but fixed at 7s. for 1939–40.

During the years of World War II, British taxation of incomes greatly increased. In 1937–38 the tax on an income of £1,000 was 10.3 per cent. By 1941–42, 30.1 per cent of the same income was claimed as income tax. Since the total amount of taxation on an income of this size was estimated to be 39.8 per cent, the importance of the income tax as a means of revenue is obvious.

During the postwar period taxation of incomes dropped generally somewhat below the wartime levels, due almost entirely to tax reductions for wage earners and low-income groups. At the same time, excise taxes were greatly increased, reducing the proportion of the British budget derived from the income tax.

**United States.** Under the burden of the Civil War an income tax was enacted in 1862 but proved unpopular, and after undergoing numerous alterations was abolished in 1872. It was declared constitutional by the Federal courts, and in one year produced over 24 per cent of the country's revenue from internal sources. In 1894 an income tax was imposed by the Wilson Tariff Act, but the Supreme Court held it unconstitutional on the ground that the income tax was a "direct" tax and direct taxes must be apportioned among the different states in proportion to their population. A tax of 1 per cent on the net income of corporations was made a part of the Payne-Aldrich Tariff Act (1909).

In 1913, after a generation of agitation and effort, the Sixteenth Amendment was passed, stating that "The Congress shall have power to lay and collect taxes on incomes, from whatever source derived, without apportionment among the several States, and without regard to any census or enumeration." An income tax was immediately enacted as part of the Tariff Law of 1913. A tax of 1 per cent was placed on the income both of United States citizens, residing either at home or abroad, and of every person residing in the United States whether a citizen or not. A similar tax was laid on the net income from all property owned and every business, profession, or trade carried on in the United States by persons residing elsewhere. An additional series of supertaxes was imposed on all incomes. In computing net income, a deduction of \$3,000 was allowed for unmarried persons and a deduction of \$4,000 from the aggregate income of husband and wife.

Since 1913 the income tax has remained a permanent source of revenue for the Federal government. Under the 1916 schedules a normal tax of 2 per cent was levied on all incomes not exceeding \$20,000, and the rates were materially increased under the provisions of the War Revenue Act of 1919. A normal tax of 6 per cent was laid on individual incomes up to \$6,000 and one of 12 per cent on incomes above \$8,000. In addition a surtax of 1 per cent was laid on the amount by which the net income exceeded \$5,000. This surtax was graduated to a rate of 65 per cent on incomes above \$1,000,000. The personal exemption was reduced from \$3,000 to \$1,000, and the exemp-

tion for a head of a family or for a married person living with husband or wife was reduced from \$4,000 to \$2,000, with an additional \$200 for each dependent.

The normal tax rate was reduced somewhat by the Revenue Act of 1921. Under the provisions of this act a normal tax of 4 per cent was levied on the first \$4,000. The surtax for the calendar year 1921 ranged from 1 per cent on the amount by which the net income exceeded \$5,000 and did not exceed \$6,000, to 65 per cent of the amount in excess of \$1,000,000. For the calendar year 1922 and for each year thereafter the surtax was to be 1 per cent on the amount exceeding \$6,000 and not exceeding \$10,000 and 50 per cent of the amount exceeding \$200,000. The personal exemption for the head of a family with a net income of less than \$5,000 was increased to \$2,500, but for one with an income over \$5,000 the exemption remained at \$2,000. The allowance for each dependent was increased to \$400.

Under the Revenue Act of 1924 the normal rate was again reduced to 2 per cent on the first \$4,000 of income, 4 per cent on the next \$4,000 and 6 per cent on the balance over \$8,000. Surtaxes were levied, varying from 1 per cent on income in excess of \$10,000 and not more than \$14,000, to 40 per cent on income in excess of \$500,000. The exemption for heads of families was raised to \$2,500. A special provision reduced the income tax payable for 1923 by 25 per cent. Publicity as to names, addresses, and payments of taxpayers was permissible.

In 1924 Congress made the first attempt to differentiate between earned and unearned income. It was provided that "in case of an individual the tax shall . . . be credited with 25 per cent of the amount of the tax which should be payable if his earned net income constituted his entire net income; but in no case may the credit so allowed exceed 25 per cent of the amount normally due." Earned income was defined as income from wages, salaries, professional fees or payments for personal services, up to any amount not exceeding \$10,000.

Under the Revenue Act of 1926 a normal tax of 5 per cent was laid on individual incomes. This was modified in the case of citizens or residents of the United States to a rate of 1½ per cent on the first \$4,000 or part thereof of taxable income, 3 per cent on the next \$4,000 and 5 per cent on all additional income. A tax of 13 per cent was laid on the net incomes of corporations for the year 1925, and 13½ per cent for each year thereafter. In addition to the normal rate, a surtax was laid on individual incomes, ranging from 1 per cent on incomes of from \$10,000 to \$14,000, to 20 per cent on incomes of \$100,000 and more. The 1926 act abolished the publicity clause of the 1924 measure and raised income exemptions to \$3,500 for married persons and \$1,500 for single persons; the possible amount of earned income was raised to \$20,000. In 1928 the rate of corporation income tax was reduced from 13½ per cent to 12 per cent. In 1929 a tax reduction of \$160,000,000 was affected by Act of Congress reducing the rates of normal tax on the taxable net incomes of individuals from 1½ to ½ of 1 per cent on the first \$4,000, from 3 to 2 per cent on the second \$4,000, and from 5 to 4 per cent on the rest. This act also reduced the corporation rate from 12 to 11 per cent.

In 1932 Congress increased the individual normal tax to 4 per cent on the first \$4,000 of income and 8 per cent on the remainder. Surtax rates began at 1 per cent on taxable incomes in excess of \$6,000 but not in excess of \$10,000 and rose to 55 per cent on incomes exceeding \$1,000,000. The tax rate on corporations was fixed at 13¾ per cent. Personal exemptions were reduced to \$2,500 and \$1,000 for married and single persons, respectively, with an exemption of \$400 for each dependent other than husband or wife.

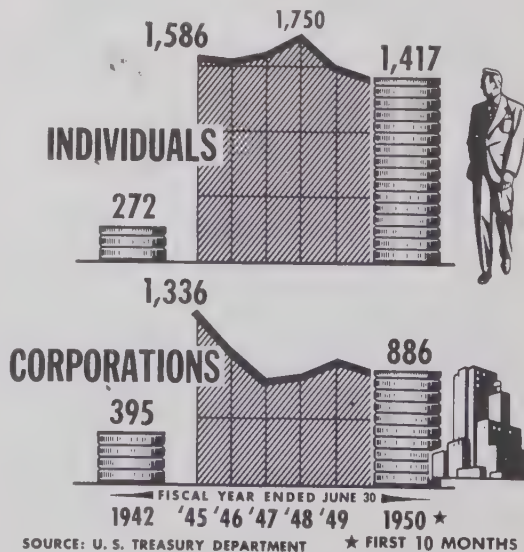
The Revenue Act of 1934 lowered the normal rate on individual incomes from 4 and 8 per cent to 4 per

cent, and allowed, for the purpose of normal tax, a credit against net income of 10 per cent of earned income; in no case was the earned net income to exceed \$14,000. Surtaxes were graduated from 4 per cent on "surtax net income" in excess of \$4,000 and not in excess of \$6,000, up to 59 per cent on such income in excess of \$1,000,000. Certain clauses were aimed at closing loopholes for avoiding payment of taxes. Amendments passed in 1935 increased surtaxes on surtax net incomes over \$50,000, the rate reaching 75 per cent on such incomes over \$5,000,000.

The Revenue Act of 1936 included an undistributed profits tax on corporations, scaled from 7 to 27 per cent, a feature designed to encourage the declaration of dividends and make wealthy persons pay high surtaxes. Besides, individuals were required to pay normal taxes as well as surtaxes on dividends received from corporations, instead of merely surtaxes as formerly. The normal tax on corporations, under the 1936 law, rose from 8 per cent on normal-tax net incomes not in excess of \$2,000, to 15 per cent on such incomes in excess of \$40,000. Changes embodied in the law of 1937 were designed to close loopholes in the 1936 act by sharp increases in the tax rates for personal holding companies.

The rates of income tax on individuals were not altered by the Revenue Act of 1938. The measure's most noteworthy feature was that it greatly modified the undistributed profits tax and the capital-gains tax. The undistributed profits tax, criticized by businessmen as penalizing the accumulation of necessary reserves, was eliminated with regard to small corporations and retained in little more than principle for large ones. At the same time new tax rates for corporations were adopted, but these rates were slightly altered by the Revenue Act of 1939. Under the latter measure normal-tax net income of \$25,000 or less was taxed progressively from 12½ to 16 per cent; the rate on amounts over \$25,000 was 18 per cent.

These corporation tax rates were increased 1 per cent by the (First) Revenue Act of 1940 (viz., 13½ to 17 per cent, and 19 per cent, respectively). The act also lowered personal exemptions to \$800 for single persons and \$2,000 for married persons, and raised surtaxes. In addition, a "defense" tax, enacted for five years, increased most income taxes by 10 per cent (of such taxes). The Second Revenue Act of 1940 increased the corporation tax rate on normal-tax net income over \$25,000 to 22½ per cent (making the



Federal Income and Profits Taxes, in millions of dollars, 1942-50



effective rate, including defense tax, 24 per cent), with specified deductions. Also, an "excess profits" tax was imposed. See EXCESS PROFITS TAX.

In 1941 defense needs forced a great increase in the income tax. The exemption of a single person was reduced to \$750 and of a married couple to \$1,500; other allowable deductions included \$400 for each dependent and an earned income credit of 10 per cent against the normal tax. The regular tax rate of 4 per cent for net income was retained, but the surtax was raised sharply, beginning at 6 per cent on the first \$2,000 of net income and reaching 77 per cent on incomes above \$5 million. The corporation tax was also raised. See CORPORATION TAX.

During World War II income taxes were raised several times, reaching their peak in 1945. The exemption of a single person was lowered to \$500 and the deduction for each dependent reduced to \$350. Rates were greatly increased in the lower incomes, and since most taxpayers were in this class the change in rates netted a substantial increase in revenue. In 1943 the withholding tax was introduced so that employers withheld a percentage of all wages and salaries and remitted the amount directly to the government. In 1945 after the war ended both individual and corporation taxes were reduced; in 1948 individual income tax rates were reduced again, personal exemptions were raised, and husband and wife were allowed to file separate returns dividing their income equally as in "community property" states.

In 1950 and 1951 during the Korean War, Congress raised individual income taxes, increased corporation taxes, and restored the excess profits tax (which had been dropped in 1945). These changes established the highest tax structure in U.S. history. In 1954 after the Korean War ended both individual and corporation taxes were lowered. There was no reduction in the basic tax rates but deductions were added or increased for the benefit of taxpayers.

**The Revenue Act of 1954.** Every person with a gross annual income of \$600 or more was required to file an income tax report. The date for filing became April 15. The tax was to be computed from official tax schedules and the instructions were to be followed in detail. In general, when the taxable income was not more than \$2,000 the tax was 20 per cent of the taxable income. For a single taxpayer when the taxable income was more than \$2,000 but not more than \$4,000 the tax was \$400 plus 22 per cent of the excess over \$2,000; for a married taxpayer filing a joint return the tax in this taxable income category was 20 per cent of the taxable income. The taxable income was the gross annual income minus the total of exemptions and allowable deductions. Every taxpayer was allowed an exemption of \$600 for himself and a similar exemption for each member of the family (or household) qualifying as a dependent. The taxpayer could deduct his contributions to religious, educational, literary, scientific, and charitable organizations but the total was not permitted to exceed 20 per cent of the adjusted gross income; there was a 10 per cent additional deduction which was to be computed separately. Other deductions included allowable business losses, real estate and sales taxes, and certain medical and dental expenses. In most cases it was advantageous for a married couple to file a joint return.

**State Income Taxes.** As of 1953, 31 states and the District of Columbia were using the income tax. Wisconsin took the lead in adopting an income tax law in 1911, and it was followed by 14 other states by 1928. Between that year and 1933 the acute need for revenue and the desire to check the growing pressure of property taxes in the depression period caused many other states to adopt the income tax. In general, the states followed the policies of the federal government in regard to definition and concept of income, although there resulted a number of differences in the state legislation, owing in part to the limitations of

state authority. By mid-century, 33 states taxed corporate net incomes, some making various distinctions between business corporations, national banks, and state banks.

**Criticism of the Income Tax.** This form of tax has been the subject of a vast amount of criticism and

RELATION OF INCOME AND PROFITS TAX  
RECEIPTS TO TOTAL RECEIPTS OF  
UNITED STATES GOVERNMENT

*Selected Fiscal Years, from 1915*

| YEAR      | INCOME AND PROFITS<br>TAX RECEIPTS | TOTAL<br>RECEIPTS |
|-----------|------------------------------------|-------------------|
| 1915..... | \$ 80,210,759                      | \$ 697,910,827    |
| 1920..... | 3,944,949,288                      | 6,694,565,389     |
| 1925..... | 1,760,537,824                      | 3,780,148,685     |
| 1930..... | 2,410,986,978                      | 4,177,941,702     |
| 1935..... | 1,099,118,638                      | 3,800,467,202     |
| 1940..... | 2,125,325,000                      | 5,893,368,000     |
| 1941..... | 3,469,638,000                      | 7,995,612,000     |
| 1943..... | 16,093,669,000                     | 23,402,322,000    |
| 1945..... | 35,173,051,000                     | 47,750,306,000    |
| 1948..... | 31,170,968,000                     | 46,098,807,000    |
| 1949..... | 29,482,284,000                     | 42,773,506,000    |
| 1950..... | 28,969,000,000                     | 41,311,000,000    |
| 1952..... | 51,347,000,000                     | 62,129,000,000    |
| 1953..... | 54,037,000,000                     | 64,825,000,000    |
| 1954..... | 53,906,000,000                     | 64,655,000,000    |
| 1955..... | 49,422,000,000                     | 60,302,000,000    |

controversy, both deserved and undeserved. It has often been attacked on the grounds of being too complicated, although it must be remembered that simple taxes are often the most unfair and that a tax to work equitably and flexibly must of necessity involve certain complications. Another criticism has been that the income tax can be shifted from those with high incomes to the general public. The amount of such shifting that can be carried out, however, is so slight as to be negligible. A more valid criticism of the tax lies in the fact that the income tax is more subject to fluctuations in the amount collected than any other tax since it depends so entirely on the national income. The income tax has also received some criticism as being class legislation, since a large portion of the lower-income population is exempt. Actually, however, the income tax is considered by most leading economists to be one of the fairest types of taxation. Many of its faults have perhaps arisen from the rates established and the methods of administration rather than from the inherent nature of the tax. See TAXATION; INCOME.

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**INCOMMENSURABLE.** See COMMENSURABLE QUANTITIES.

**INCONNU**, or **MACKENZIE RIVER SALMON**, known locally as the Conny, inhabits the rivers of Arctic America and Asia. It is an oil fish, somewhat resembling the salmon and whitefish, and averages between 5 and 15 pounds, though many specimens are much heavier. The coarse-scaled, silver body is somewhat flattened; the almost square mouth has a peculiar projecting rim. The inconnu, *Stenodus mackenzii*, is an excellent food fish.

**INCONVERTIBLE PAPER CURRENCY.** See PAPER MONEY; MONEY.

**INCORPORATION.** See CORPORATION.

**INCORRIGIBLES.** See CRIMINOLOGY; PARDON; PAROLE; PRISONS.

**INCREMENT, UNEARNED.** See UNEARNED INCREMENT; SINGLE TAX; TAXATION.

**INCUBATION** commonly signifies the process of development of the egg into a complete animal out-

side of the body of the parent. In the strict sense of the term incubation is peculiar to birds, although brooding over eggs or young is also observed among some insects, amphibians, and reptiles. Among the mammals only the primitive spiny anteater, *Echidna*, and duckbill, *Ornithorhynchus*, incubate. The *Echidna* carries its eggs in a pouch resembling that of marsupials; the duckbill broods its eggs in a nest in a burrow.

In birds it is necessary that the egg, when laid, be kept at an elevated and relatively uniform temperature for a certain period of time, which differs among the various species. This temperature is usually effected and maintained by the high body-temperature of the parents, which brood over the eggs in a nest often lined with some insulating material. In some species, e.g., most of the finches and sparrows, only the female incubates. Among many of the smaller birds the female alternates periods of 12 to 50 minutes sitting on the nest with periods of 5 to 17 minutes off it for feeding. In other species, perhaps the majority of birds, both sexes incubate with the sexes spelling one another at intervals ranging from as short as 2 to 15 minutes for some of the smaller birds to as long as several days for the penguins and albatrosses. The male ostrich spends the night on the nest and is replaced by the female during the day. In a few species, only the male incubates.

The duration of incubation varies considerably among birds. It is normally 12 to 13 days for the song sparrow, English sparrow, and cardinal; for the domestic hen, 20 to 21 days; for most ducks, 28 to 32 days; for the ostrich, 40 to 42 days; for the peregrine falcon, 61 days; for the blackheaded gull, 75 days; for the lapwing, 88 days; and one record for the kiwi in captivity indicates a duration of 120 days.

The most accurate studies on the temperature of incubation have been made upon the domestic hen. The body temperature of the brooding hen varies during incubation between 102.2° and 105.2° F. with the eggs maintained at only 1½° to 3° lower.

The mound birds, and also the reptilian alligator, deposit their eggs in a heap of decaying vegetation where the heat generated is adequate for normal development. Sea-turtles bury their eggs in sand above the high-tide level where heat from the sun's rays provide sufficient warmth.

The term incubation has been adopted in pathology to describe the period intervening between time of infection and that of onset of the first acute symptoms of a disease. In bacteriology and in parasitology, cultures of organisms in appropriate media, which are maintained at some uniform temperature to induce reproduction and development, are said to be incubated.

FRANK A. BROWN, JR.

#### INCUBATOR (POULTRY), AND BROODER.

An incubator is a heated machine used in poultry raising for the purpose of hatching eggs in large quantities.

Artificial methods of hatching and rearing chickens have largely displaced, in recent years, the natural method of using brood hens for the purpose. Factors which have contributed to the large-scale use of incubators and brooding devices include the economic desirability of hatching chickens at times during the year when few hens are broody and the high degree of development which artificial methods of incubation have attained.

Incubators of various types are available. All consist essentially of a boxlike enclosure into which fertile eggs may be placed for the period of incubation. In the modern, automatic incubator, controls are available for the regulation of air, moisture, and heat, which is provided by hot water, hot air, kerosene lamps, coal burners, or electrical heating units. Incubators are frequently arranged in batteries so that free access may be available to each one without disturbing the others. They range in size from small types holding from 25 to 500 eggs to large types holding 15,000 or more eggs at one time.



U.S.D.A.

Battery of incubators for hatching chicks

The temperature within the incubator is maintained at from 100° to 104° F. depending upon the type of machine being used. Moisture and ventilation are additional factors which influence results in artificial incubation. In some cases moisture is provided by wetting the floor of the room in which the incubator is located so that moisture enters the incubator with air taken in. In cold weather the necessity for adding moisture is greater than in warm. Among other things the moisture aids in softening the egg shell so the chick can break through.

For some types of incubator it is necessary that the room in which the device is located be maintained at an even temperature of from 60° to 70° F. Other incubators produce good results in areas where temperature variations occur over a considerable range. Sufficient ventilation is necessary to carry away impure air.

Eggs which have been properly stored deteriorate relatively little in hatchability up to about seven days. Only the best eggs are used for incubation. When hatching has begun within the incubator, as indicated by the piping of the shell, the device should remain closed until the hatch is complete.

After the chickens are hatched they are reared in various types of brooders. These consist of enclosures of various sizes equipped with a device for radiating and conserving heat. They are used for young chickens up to eight weeks of age. Some brooder devices are portable.

A system of chicken rearing of more recent development employs the battery brooder. The chickens are kept in compartments having wire net floors under which are trays to collect the excrement. These compartments are stacked four or five tiers high and proper heat is provided. A scientifically designed diet is provided and the chickens are not allowed to touch the ground. See POULTRY AND POULTRY FARMING.

**INCUBATOR BABY.** Almost always a baby who has to be placed at birth in an incubator and kept artificially warm is one born prematurely, that is,

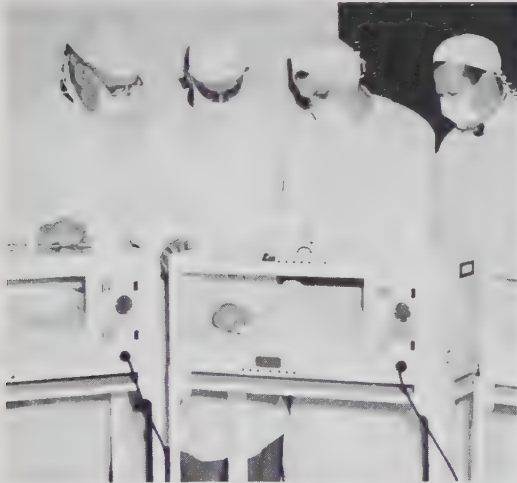


one not carried by its mother for a full term of nine months. Such infants are not really ready for the outside air, and are underweight and rather weak. As a rule a baby is considered premature and has to be placed in an incubator immediately after birth if it weighs less than five and a half pounds. The smallest infant known to have survived into childhood weighed about one pound at birth. Few infants weighing less than two pounds survive, though the number of such babies who can be saved is constantly increasing, thanks to modern methods of care. See EMBRYOLOGY OF MAN.

The use of incubators for premature babies is comparatively recent. When they were first tried the incubators were just about large enough for a single baby. Now many modern hospitals have air-conditioned cubicles where the temperature is kept between 75° and 100° F.—usually around 80° F.—and where the humidity, or moisture, is controlled. Of course this is much safer for the tiny infant than any kind of wrappings because the temperature and moisture are kept even at all times. The use of incubators has greatly increased the chances of survival of premature infants. Instead of dying almost immediately, as most of them formerly did, with incubator care all except the smallest have an excellent chance. The feeding of such infants, sometimes with a medicine dropper, is an important part of the care while they are in the incubator.

Premature babies grow faster at first than full-sized infants. A child weighing only three or four pounds at birth usually catches up with the seven or eight pound child within a year or two. Except for a short period after birth the incubator baby is no more susceptible to disease or other troubles than normal-sized children. In fact, incubator babies who live past the danger period of a few weeks are just as likely to be healthy and to live as long as full-sized babies.

EDWIN P. JORDAN, M.D.



GORDON ARMSTRONG CO.

**Incubator Baby.** Premature babies are characterized by irregular temperature; in this incubator with electrically controlled temperature and humidity, the proper body temperature is maintained at all times

Statute of Frauds), as to the requirements that they be in writing.

**INDEMNITY, MILITARY.** See REPARATIONS.

**INDENTURE.** See DEED.

**INDENTURED SERVANT,** a person, usually an adult white, bound to labor for a term of years, as, notably, in the American colonies. Indentured, or indented, servants fell into two classes, voluntary and involuntary. The former comprised a great number of men and women, chiefly English, German, and Scotch-Irish, who, in order to migrate to America, bound themselves to serve a master (under a contract or indenture) for a number of years, ranging from two to seven, in payment of their transportation and maintenance. Involuntary servants included convicts and paupers who were sentenced to deportation and were indented, commonly for seven years, after reaching America, and also persons, especially children, who were kidnaped, shipped to the colonies, and sold into service—a practice known as “spiriting.” The terms of an indenture could be enforced in court; and runaway servants could be forced to return and to serve out additional time in penalty. Though the treatment of indentured servants varied, their lot apparently was not usually onerous. At the end of their terms of service they commonly received some clothing and other provisions or the equivalent in money, and sometimes a small tract of land; and apparently they suffered no social inferiority because of their past status.

IRVING FRYER

**INDEPENDENCE,** city, SE Kansas, county seat of Montgomery County, near the junction of the Elk and the Verdigris rivers, on the Santa Fe and the Missouri Pacific railroads and U.S. highways 75 and 160; about 125 miles S of Topeka. It was settled in 1869 and named for Independence, Iowa. The city has oil industries, natural gas reservoirs, and the manufacture of metal, laminated wool, washing machines, cement, alfalfa, and natural and butane gas carburetors. Pop. (1950) 11,335.

**INDEPENDENCE,** city, W Missouri, county seat of Jackson County, on the Alton, the Missouri Pacific, and the Kansas City Southern railroads and U.S. highways 24 and 71; three miles E of Kansas City. The first permanent settlement was made here in 1825. A small trading village by 1827, Independence became the headquarters of the wagon trains starting west on the Santa Fe, the Oregon, and the California trails. In 1831 the Mormons chose Independence as their “promised land,” but they were driven out in 1833. There were many guerrilla raids in the town during the Civil War. President Harry S. Truman’s home, used by him as a summer White House, is located in Independence. The town, primarily residential, is virtually a suburb of Kansas City. There are some minor manufactures including furnaces and flour. Pop. (1950) 36,963.

**INDEPENDENCE DAY, or FOURTH OF JULY,** the day on which Americans celebrate the birth of their country’s independence. Independence Day commemorates the adoption by the Continental Congress on July 4, 1776, of the DECLARATION OF INDEPENDENCE, which declared to all the world “that these United Colonies are, and of Right ought to be Free and Independent States.” The Fourth of July has ever since held a hallowed place in American life, marking as it does the end of the American colonial period and the entrance of the United States onto the stage of history. Although the Fourth of July was soon set aside as a day of rejoicing over national independence, the actual “resolution of independence” was ratified by the Congress two days earlier. The event which took place on July 4 was the adoption of the historic document known as the Declaration of Independence, which had been drafted by a committee headed by Thomas Jefferson. July 2nd was for several years celebrated as Independence Day, but this practice soon gave way, the founding fathers preferring to keep the day on which their

**INDEMNITY,** an agreement, either express or implied, to secure or save a person harmless from some specific loss or damage which may happen in the future; also the money paid to reimburse one for loss, as in eminent domain. A contract of indemnity is subject to the general rules applicable to contracts, such as the requirement of CONSIDERATION. In many respects the undertaking is synonymous with contracts of GUARANTY, SURETYSHIP, and INSURANCE, but in many instances indemnity contracts have not been held to fall within the Statute of Frauds (see FRAUD,

decision had been announced to the world in the ringing words of Jefferson's Declaration.

Sitting in his room the day after the adoption of the initial resolution, John Adams envisioned the celebration of Independence Day through the coming years. Jubilantly he wrote to his wife, "The 2nd day of July, 1776, will be the most memorable epoch in the history of America. I am apt to believe that it will be celebrated by succeeding generations as the great anniversary festival. It ought to be commemorated as the day of deliverance, by solemn acts of devotion to God Almighty. It ought to be solemnized with pomp and parade, with shows, games, sports, guns, bells, bonfires, and illuminations, from one end of this country to the other, from this day forevermore." John Adams foresaw the future clearly (except



Centennial Independence Day celebration

as to the date of celebration), for Independence Day became one of his country's most cherished holidays. Early Americans, however, celebrated their independence with more enthusiasm and violence than is the custom today. Open air meetings were held throughout the country and fiery patriotic speeches were delivered to cheering crowds. Cannon were fired and great torchlight parades illuminated the evenings of the "Glorious Fourth." But there began a protest against such celebration because of the number of people killed and injured by fireworks and the discharging of small arms, and a movement grew for a "safe and sane Fourth." Many communities now prohibit the sale of fireworks, and Independence Day is being increasingly celebrated by group picnics and family outings. The Fourth of July is a legal holiday throughout the United States and its possessions. See **DECLARATION OF INDEPENDENCE**.

R. W. QUINN

**INDEPENDENCE, DECLARATION OF.** See **DECLARATION OF INDEPENDENCE**.

**INDEPENDENCE HALL**, a famous historical building situated on Chestnut Street, Philadelphia. Originally erected in 1732-34, it was used as the Pennsylvania State House, and from 1775 to 1781 was the meeting place of the Continental Congress. Here Washington was appointed commander in chief, and in the east room the **DECLARATION OF INDEPENDENCE** was signed. During 1789-1800 the hall was the seat of the United States Supreme Court. The famous **LIBERTY BELL** hangs in the rear hall of the first floor. The place was restored in 1898, and now contains a collection of Revolutionary relics.

**INDEPENDENT ORDER OF ODD FELLOWS.** See **ODD FELLOWS**, **INDEPENDENT ORDER OF**.

**INDEPENDENTS.** See **CONGREGATIONALISM**.

**INDETERMINATE EQUATION**, one that contains two or more unknown quantities (variables) and has, therefore, no unique solution. An example of such an equation is  $3x+2y=7$ ; it has infinitely many solutions, or pairs of values of  $x$  and  $y$  that will satisfy the equation, because it is possible to calculate a value of  $y$  to correspond with each value that may be assigned to  $x$ . It is by plotting points whose coordinates are calculated from an indeterminate equation,  $y=f(x)$ , that one is able to draw a *graph* of the function  $f(x)$ . (See **FUNCTION**; **GEOMETRY**, **ANALYTIC**.) Indeterminate equations in which the variables are limited to integral (whole number) values only are called *Diophantine equations*, and the process of finding the integral solutions is called *Diophantine analysis* (see **DIOPHANTUS**). An interesting problem of this type is to find integral solutions for the equation  $x^2+y^2=z^2$ . This amounts to finding every right triangle for which the legs and hypotenuse are whole numbers (see **PYTHAGOREAN THEOREM**). An *indeterminate system of equations* is a set of equations at least one less in number than the number of variables involved. See **EQUATION**, *Simultaneous Equations*.

A. T. M.

**INDETERMINATE FORM**, in mathematics, an algebraic or other analytic expression that, for some specific value of the independent variable (see **FUNCTION**), has a form that is meaningless, or not defined. Such forms are  $0/0$ ,  $\infty \times \infty$ ,  $0 \times \infty$ ,  $\infty - \infty$ ,  $0^0$ ,  $\infty^0$ , etc. By methods of the calculus it is often possible to evaluate such a form; that is, to assign to the function a value that will make it *continuous* at the critical value of the variable (see **CONTINUITY**). For example, when  $x=3$ , the function  $y=(x^2-9)/(x-3)$  has the form  $0/0$  and is therefore indeterminate and without meaning, since division by zero is not possible. When  $x$  has any other value than 3, however, then  $y=(x^2-9)/(x-3)=x+3$ . The values of  $y$  corresponding to  $x=2.0, 2.5, 2.9, 2.99$ , etc., are found, by calculation, to get closer and closer to 6 as  $x$  gets closer and closer to 3; that is, the **LIMIT** of the function  $y$  as  $x$  approaches 3 is 6. By assigning this value to  $y$  when  $x=3$  there is no break or discontinuity at that place in the function.

A more general method of evaluating the forms  $0/0$  and  $\infty/\infty$  is provided by *L'Hospital's rule* (also written *Lhopital*): namely, if the function  $f(x)/F(x)$  is such that  $f(x)$  and  $F(x)$  each become zero (or **INFINITE**) for  $x=a$ , then the limit of the quotient  $f(x)/F(x)$  as  $x$  approaches  $a$  is equal to the limit of the quotient of the *derivatives* of  $f(x)$  and  $F(x)$ , if such a limit exists (see **CALCULUS**). In symbols:

$$\lim_{x \rightarrow a} \frac{f(x)}{F(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{F'(x)}$$

Applied to the example above, this rule gives:

$$\lim_{x \rightarrow 3} \frac{x^2-9}{x-3} = \lim_{x \rightarrow 3} \frac{2x}{1} = 6$$

as before. If  $f'(x)/F'(x)$ , in turn, is indeterminate, it is necessary to repeat the process. Several repetitions are sometimes required.

A. T. M.

**INDETERMINATE SENTENCE**, in criminal law, a sentence imposed upon a convicted offender for an indefinite period of time (usually between



minimum and maximum limits), the eventual length being determined by the behavior of the prisoner. It is based on the theory that it enables the application of one of the objectives of imprisonment—the reformation of the offender and his restoration to society—in that it affords him the opportunity to a help in his regeneration by holding out the hope of a speedier release. See PRISON; CRIMINOLOGY.

**INDETERMINISM.** See DETERMINISM.  
**INDEX**, an alphabetical list of topics included within a publication or group of publications. Purpose of the index is to locate information undiscoverable except by reading line for line. The index may be elaborately subdivided and use cross references as aids in finding information on a given subject. Each subject listed is accompanied by the number of the page on which information is given.

For the first 50 years after the invention of printing, tables of contents were much more common than alphabetized indexes. The latter came into fairly wide use in the sixteenth century, although it was not until a century later that the word “index” in England superseded the older “table.” In 1878 H. B. Wheatley’s *What is an Index?* drew attention to the importance of good indexing; and the publications (1879–91) of the English Index Society, formed in 1877, embrace indexes of various kinds, some of them being rather of the nature of bibliographies and iconographies. Indexing is now taught in connection with library training and also as an occupation.

Preparation of an index consists of three divisions: compilation, arrangement, and printing. The method of procedure generally adopted is to write each entry on a separate card or slip of paper (which must not be too small), and then to arrange, edit, and number these slips for the printer. Poole’s *Index to Periodical Literature* (1882–1903), *The Reader’s Guide*, indexes in the Royal Society’s *Catalogue of Scientific Papers* (1867–1902), and the card catalogues of modern libraries are good instances of the development of indexing. See CATALOGUING.

**INDEX**, in mathematics. See EXPONENT; INVOLUTION.

**INDEX**, of forbidden books, in the Roman Catholic Church, since 1917 issued by the Holy Office. Literally, it is a list of writings which Catholics are forbidden to read. Many books had been condemned before the Catholic Reformation, but not until then was a specific list made. The Index was completely revised by Leo XIII in 1900. Books thought dangerous or prejudicial to faith and morals are generally condemned by the authority of the Index, but titles of specific books condemned since 1600 are listed. No attempt is made to list all books that might be condemned. A publication is specifically condemned only when the reading of its contents is considered to be popularly dangerous to Catholics. For such good reasons as literary study, philosophical research, or defense of faith, Catholics are given permission to read books “on the index.”

**INDEX, CEPHALIC.** See ANTHROPOLOGY.

**INDEX NUMBER**, a statistical device for measuring over stated periods of time changes in groups of data. Typical of the data so measured are percentage increases and decreases and variations in employment, wages, group health, or income. In all cases, either the most typical period or some arbitrary period for which basic data are available is taken as the base period and assigned an index number of 100. The base period is the standard against which other periods are compared and assigned an index number of their own. Each index number thus is a figure of percentage as compared with the base period. Table 1 illustrates an index series.

The base period may be 1950 as in column 3 or 1955 as in column 4; it could be made to be any of the intermediate years as well. Since an index number is a percentage value, it is computed by finding what part of the base period value any other period’s value

Table 1. INDEX OF NET INCOME  
OF FARM OPERATORS

| YEAR      | INCOME<br>MILLIONS OF DOLLARS | INDEX    |          |
|-----------|-------------------------------|----------|----------|
|           |                               | 1950=100 | 1955=100 |
| 1950..... | \$13,716                      | 100      | 125      |
| 1951..... | 16,111                        | 117      | 147      |
| 1952..... | 14,888                        | 109      | 136      |
| 1953..... | 12,813                        | 93       | 117      |
| 1954..... | 12,307                        | 90       | 112      |
| 1955..... | 10,961                        | 80       | 100      |

SOURCE: *Statistical Abstract of the United States*

is and multiplying the result by 100. For example, if the base period is 1950 and the index number for 1951 is to be computed, the operation is as follows:  $16111/13716 \times 100 = 117$ .

The index in Table 1 is an arithmetic index showing percentage variation for a homogeneous set of data. Table 2 is an arithmetic index indicating the trend in motor fuel consumption in terms of a base year of 1956 (1950 = 100).

Table 2. INDEX OF MOTOR FUEL CONSUMPTION

| YEAR      | CONSUMPTION<br>MILLIONS OF GALLONS | INDEX    |  |
|-----------|------------------------------------|----------|--|
|           |                                    | 1950=100 |  |
| 1950..... | 40,280                             | 100      |  |
| 1951..... | 42,951                             | 107      |  |
| 1952..... | 45,526                             | 113      |  |
| 1953..... | 47,890                             | 119      |  |
| 1954..... | 49,636                             | 123      |  |

SOURCE: *Statistical Abstract of the United States*

Another type of index number is the aggregative index, a familiar example of which is the Bureau of Labor Statistics Consumer Price Index, measuring the average changes in prices of goods and services typically bought by city families of wage earners and clerical workers. This index is based on prices of about 300 items that are so selected that their price changes represent the movement of prices of all goods and services purchased by such families; they include all of the important items in family spending. Prices of these items are obtained in 46 cities, chosen to represent all urban communities in the United States. In calculating the aggregative index, one averages all price changes for various items in each city together with weights that represent their importance in family spending. City data are then combined in the total index with weights based on the 1950 populations of cities they represent. Index numbers are computed on the base 1947 to 1949 = 100.

Four other types of index have found some use: geometric, harmonic, median, and mode indexes. The most widely used, as well as the easiest to compute and understand, however, are the arithmetic and the aggregative types. The other four are useful only under special circumstances. For instance, the geometric index is significant where a rapid rate of growth occurs.

Index numbers are valid only when the data from which they are drawn are complete and accurate. Furthermore, if the base period selected does not represent a typical case, the index numbers calculated against it will give a false impression. A monthly index of construction activity for New York City, for example, would hardly have meaning if February, a month in which there is relatively little construction done there, were selected for the base period. Notwithstanding such limitations index numbers are a powerful tool for the interpretation of statistical information because they are readily understandable and easy to construct.

DE VER SHOLES



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## India

### INDIA Great Asian State

*Rich in tradition and culture, this new republic has just begun its industrial revolution*

**INDIA**, a great subcontinent of South Asia separated from Asia proper by the Himalaya Mountains; populated with diverse peoples speaking more than 200 languages, and prior to 1947, consisting of the Dominion of India, which contained some 600 feudatory states; area 1,581,410 sq. mi.; pop. (1951) 432,578,624. In 1947 the Dominion of India was partitioned into India and Pakistan. The subcontinent of India is bordered on the west by the Arabian Sea, Iran, and Afghanistan; on the north by the Union of Soviet Socialist Republics, Sinkiang Province of China, and Tibet; on the east by Burma and the Bay of Bengal; and on the south by the Indian Ocean. In the Himalaya Mountains, which form the northern boundary, are the independent kingdoms of NEPAL and BHUTAN. Within the great Indian Peninsula the Portuguese have the territories of Diu, Damão, and GôA. Ceylon, the Laccadive and Amindive islands, and the Andaman and Nicobar islands may also be included. For the location of the subcontinent, see Atlas, Vol. 20. See PAKISTAN; DIU; DAMÃO.

#### PHYSICAL FEATURES

The physical divisions of India comprise the borderland on the northwest frontier, and the main Indian peninsula, with its three subdivisions of the alluvial plains of upper India, the Deccan plateau, and the maritime districts.

**The Northwestern Borderland.** The crumpling and folding of the rocks in late Tertiary times have given to India on the northwest its magnificent frontier of mountain ranges, through whose softer beds the rivers have cut a path to the Indus and formed the passes by which friend and foe have poured into India. From Wakhan, through Yasin, Chitral, and Swat, the Shandur Range is an offshoot of the Hindu Kush system, which even extends its long arm to the Safed Koh Range, enclosing the Kabul River and the Khyber Pass. In turn the Safed Koh throws off southern spurs, the Samana and the Shutur Gardan, whose rugged limestone ridges let through the waters of the Kurram and the Tochi. Then comes the highland of Waziristan; and the Gumal River marks in general terms the divide between the democratic tribes of Pushtu-speaking Pathans, and the Baluchia of Persia and the Brahuis of Dravidian origin. A new mountain range of tilted strata of recent formation, in which the stately deodar is replaced by juniper, commences south of the Gumal and takes its name from its main peak, the Takht-i-Sulaiman, 11,289 feet in height. Its parallel serrated ridges of limestone are then pushed back by the sandy desert of Gan-

dava, and, threaded by the Bolan Pass, are curved from their southerly course until they are piled up into a knot of mountains about Quetta. From there one range goes off to the north in the Jhojak, while another runs down to the coast at Karachi.

**The Peninsula.** In the north the Himalayas rise to a mean elevation of 18,000 feet in successive ranges, occupying a breadth of some 200 miles and sweeping in a continuous curve of 1,500 miles from Kashmir to Assam. Beneath them lies a marshy valley known as the Tarai. The Sivalik Range, where many vertebrate fossil remains have been found, encloses the valleys and runs in the same direction as the Himalayas from Hardwar, in the northwestern section of Uttar Pradesh, to the banks of the Beas.

Below the mountain barrier stretch the alluvial plains, on one side reaching the Arabian Sea, which washes the coasts of Cutch, and on the other side extending to the Bay of Bengal. In the northwest a rocky hill-system known as the Aravalli Range divides Rajasthan. The Vindhya Mountains, whose secondary sandstone formations fashion the cliffs of central India, continue almost to the Ganges below Benares. The Vindhyas form the divide between northern India and the Deccan, and in the past this barrier diverted the Aryan advance to Bengal. The plains of the Indus and Gangetic systems contain India's most prosperous and densely populated provinces. A short distance above Cambellpur the Indus receives from the west the Kabul River, which drains the southern slopes of the Hindu Kush. From the east the Indus receives the waters of the five rivers—the Jhelum, Chenab, Ravi, Beas, and Sutlej—that give the Punjab (five waters) its name. From that point the Indus flows in ever-changing channels to Sind. The Jumna, rising in Garhwal, carries the drainage of the Aravalli Mountains eastward into the Ganges at Allahabad. There at the confluence of the two great rivers is one of the most sacred places for religious ablution in India. Unlike the Indus, whose source is on the far slopes of the Himalayas, the Ganges rises on the seaward face of the higher ranges, crossing the Sivalik Range at Hardwar, and finally uniting with the Brahmaputra to form the vast delta extending for 80 miles along the Bay of Bengal. The alluvial plains created by the Ganges River system extend over the states of Uttar Pradesh, Bihar, and Bengal; the Indus River system extends through West Pakistan.

The second division of the subcontinent is the great tableland of the Deccan (Sanskrit, *Dakshina*, "south"). The Vindhyas on the north are succeeded, beyond the intervening Narbada Valley, by the Satpura Range, south of which the Tapti follows the westerly direction, taken by the Narbada, and enters the Arabian Sea near Surat. Beyond the Tapti Valley commence the West Ghats, pursuing the general line of sea-coast at a distance of about 40 miles, until they meet the Nilgiris (Sanskrit, *Nilagiri*, "blue hills"). The West Ghats were the divide when, in the Mesozoic era, the Indian peninsula was continued across the ocean to Madagascar, and so on until it joined the mainland of South Africa. At the present day the rivers which have their source in them—the Godavari with a course of 800 miles; the Kistna (Sanskrit *Krishna*, "black"), with one of 800 miles; the Cauvery; and others—run eastward and make their way through the so-called East Ghats into the Bay of Bengal. These Ghats, of lower altitude and more broken than those on the west, begin in the Mahanadi (Sanskrit, "great river") Valley near Cuttack, and stretch, at a distance of some 60 miles from the coast, southwestward for 500 miles until they end in a deep fissure under the shadow of the Nilgiris. Basins of the Gondwana system—a great sandstone formation in which coal is very generally present—lie in the northeastern quarter of the plateau, or in the valley of the Godavari. The configuration of the country and the influence of the Ghats render most of the Deccan subject to frequent droughts. The maritime



division includes on the east the alluvial and Cretaceous seaboard districts of Madras and a fringe of Bengal, with the deltas formed by the Godavari and the Mahanadi, and on the west the steamy Konkan districts of Bombay. At the extreme north, the Madras districts below the Milgiris are divided by the Palni and the Cardamon ranges of high elevation, which are continued across the straits into Ceylon.

**Climate.** The whole country has three well-marked seasons—the cool, the hot, and the rainy. The cool months are November, December, January, and a part of February; the dry hot weather precedes, and the moist hot weather follows the periodical rains. The rainy season occurs in the middle of summer and is called the monsoon. It is the occasional failure of the monsoons that causes the periodical famines to which the country is liable. The central tableland is comparatively cool, but the alternations of heat and cold differ greatly elsewhere. In the northwest there is burning heat with hot winds in summer, and frost at night in winter. In the south the heat is more tempered, but the winter is cool and not cold. The fall of rain varies greatly in different parts of the country. In the northeastern and other outlying parts it exceeds 75 inches. In the Deccan, in the upper basins of the Ganges and the Indus, it is 30 inches, and in the lower regions of the Indus, less than 15 inches. The remainder of India lies between the extremes represented by these damp and dry belts.

**Plants and Animals.** The domesticated animals are, first, the cattle—buffaloes and oxen which do the work in agriculture, and cows. The bull and cow are sacred animals to Hindus and are never killed for food by them. The indigenous breeds of horses in India are being improved by the importation of foreign sires. The pony, the donkey, and the mule are largely used. Sheep and goats are abundant. Pigs are plentiful, but are despised by the upper and middle classes of people. Monkeys are tame and are held sacred. Wild animals include the tiger, panther, cheetah, boar, bear, bison, elephant, and rhinoceros. Crocodiles and alligators infest most of the rivers. Deer of all kinds abound. The ibex and the ovisammon (the wild goat and the wild sheep) are found only in the higher parts of the Himalayas. Poisonous snakes abound. At the seaport towns, the supply of fish is excellent, and fish curing is largely practiced by the natives.

Cereals are abundant—rice, corn, millet, and wheat, and tropical products—and tobacco, sugar, ginger, and spices are plentiful. The indigenous flowers are not rich, the water lilies being the best. Flowering shrubs are very fine. Of trees in the plains near the coasts the palm with its several varieties is striking. Inland the mango fruit tree and the orange, the umbrageous banyan, the sacred peepul, and the bamboo are features in the landscape. In the hills the teak and other useful timber trees are obtained. In the Himalayas are found the cedar, the pine, the fir, and the juniper.

#### PEOPLE

**The Racial History** of India is complex. Sketching in broad outlines it can be stated that the first inhabitants were of the general type of the present day Vedda of Ceylon. Apparently the Vedda were joined along the coasts by the movement of Negroids which carried the blacks and pygmies as far east as New Guinea. These groups, at times in some purity but more frequently mixed, are still to be found in the south and central portions, where they are called Pre-Dravidians.

The next major division to reach India were the Dravidian-speaking peoples, now represented by such southern tribes as the Tamil, Telugu, and Nair, and by Hill Tribes like the Toda. At the time of their entrance they appear to have been a predominantly Mediterranean (Caucasoid) race with a mixture of Armenoid. As they pushed southward they exterminated

or intermarried with the earlier peoples and as a result now show varying degrees of mixture.

About the same time a movement from the northeast brought the Munda-Kolarian-speaking peoples into the lower valley of the Ganges and surrounding districts. These appear to have been a mixture of southern Mongoloid and Mediterranean races.

In the period between 4000–3000 B.C. there began a steady infiltration from the Pamirs of Indo-European (Aryan)-speaking tribesmen—primarily herdsman. As late as 2000 B.C. similar people appear to have been coming in by way of Afghanistan and Baluchistan. These late comers took possession of the valleys of the Indus and Ganges and then began to press southward. They were predominantly of Mediterranean race, but in the Indian environment had established themselves as a very dark skinned race (Hindu or Indic). Today those of the invaders who show the least change and intermixture persist in Kashmir and the valley of the Indus.

It was formerly believed that the Aryan-speaking people were responsible for the introduction of civilization into India, but both archaeology and history tell a different story. While the city states of the valley of the Euphrates were at their height and when Aryan tribesmen were moving into India, there were great cities and cultures in the Indus Valley. Excavations at Mohenjo-Daro indicate that these were the product of the Dravidian peoples. Even after the advent of the Aryans, they had strong trading states in the south which had contact with distant lands.

Some of the Alpine peoples who overran the Persian Plateau also penetrated India. Today they are represented in northwest India by such tribes as the Brahui. Historic movements, like that of the pastoral Sakas from Persia, the invasion of Alexander in 327 B.C., and the Huns in the fifth and sixth centuries A.D., have left traces in the cultures and peoples. The last great invasion to modify profoundly the culture of north India was that of the Mongols in the 14th century. Today India is known for its teeming millions, for its splendid temples and courts, and for its dire poverty. It has developed great philosophers and two great religions—Buddhism and Brahmanism, yet the mass of the people are illiterate and held down by the curse of caste. See RACE.

Of the more than 200 languages spoken by the people of India and Pakistan, Eastern and Western Hindi are used by far more people than any other single language. If Bihari and Rajasthani, which are frequently mistaken for Hindi, are added, the total includes more than 100,000,000 Indians, in an area covering much of northern and central India, speaking languages that have some considerable affinities. Peoples speaking these four languages are intelligible to one another.

FAY-COOPER COLE

**Religion.** According to the 1941 census, of every 100 persons in India, 65 per cent were Hindu, 24 per cent Moslem, 3 per cent followed tribal religions, 1 per cent were Christian, 1 per cent Sikh, and less than 1 per cent Buddhist. In central and southern India, and in Madras, about 89 per cent of the population was Hindu; in Assam, Bihar, Orissa, the United Provinces, Central India, Central Provinces, Rajputana, and Bombay the Hindus were in the majority. Moslems monopolized North-West Frontier Province, Baluchistan, and Kashmir, and were in the majority in the Punjab, East Bengal, and Sind, and Sylhet District of Assam, now a part of Pakistan's East Bengal. Moslems constituted about 14 per cent of the population of United Provinces, and 10 per cent of the state of Hyderabad. The Sikhs were in the Punjab, and the Jains in Rajputana, Ajmer-Merwara, and near-by states. Followers of the tribal religions were found in Bihar, Orissa, Central Provinces, and Assam. Of the Semitic religions the Moslems numbered about 92,100,000, Christians 6,316,000, and Jews 22,500. The Parsees, though numbering only about 115,000 in 1941, are important in industry and

commerce. After the establishment of the Hindu state of India and the Moslem state of Pakistan in 1947, there was a considerable exchange of residents by the two states to bring the people of the subcontinent within their proper religious sphere.

**C. S. INDIA, REPUBLIC OF**, a sovereign republic created from the greater part of the former British Dominion of India; bounded on the N by Pakistan, Tibet, Nepal, and Bhutan; on the E by Burma and the Bay of Bengal; on the S by the Indian Ocean, and on the W by the Arabian Sea and Pakistan; area 1,269,640 sq. mi.; pop. (1951) 356,829,485.

**Topography.** The northern part of India is a great plain through which the Ganges flows southward from the Himalayas. In the northeast, Assam, almost entirely separated from India by East Pakistan, is drained by the Brahmaputra, which flows southwest from the Himalayas and joins the Ganges. A great delta extends south beyond Calcutta from the junction of these two great rivers in East Pakistan. Central India is composed of a series of low-lying mountain ranges. In the south a mountain range extends along the western side of the peninsula from north of Bombay almost to Cape Comorin. Between these mountains and the western coast, steppes descend abruptly to the sea; to the east, beyond a broken plain, lie the plains of Madras. The Godavari and Kistna rivers flow from the western mountains across the central plateau into the Bay of Bengal. The Cauvery River system drains the southern part of the peninsula.

**Climate.** The climate of India is mainly subtropical. In the north there is a cool winter season and a long, hot summer. The South Indian plains are hot throughout the year but the central plateau has a mild coastal climate. The southwest monsoon (June through September) is accompanied by heavy rainfall in most of the country except the south, and by light showers in the eastern and central parts of the southern peninsula. The northeast monsoon (from October on) brings the heaviest rainfall of the year to the southeastern areas, and dry hot weather elsewhere. Rainfall varies from less than 15 inches a year in Rajputana to more than 500 inches a year in the Khasi Hills of Assam; in most areas it is from 30 to 70 inches.

**People.** Hindus are in the great majority in India, which was constituted as a Hindu state in 1947. The official language of the country is Hindi in Devanagari script. The constitution which went into effect in 1950 provided that for a period of 15 years thereafter English should continue to be used for all official purposes. There are 14 recognized languages: Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil, Telugu, and Urdu. For further information on people, see INDIA, subcontinent.

#### PRINCIPAL CITIES

|                        | Population  |             |
|------------------------|-------------|-------------|
|                        | 1941 Census | 1951 Census |
| BOMBAY                 | 1,489,883   | 2,839,270   |
| CALCUTTA               | 2,108,891   | 2,548,677   |
| MADRAS                 | 777,481     | 1,416,056   |
| DELHI (inc. New Delhi) | 521,849     | 1,191,104   |
| HYDERABAD              | 739,159     | 1,085,722   |
| AHMADABAD              | 591,267     | 788,333     |
| BANGALORE              | 248,334     | 778,977     |
| CANNPORE (KANPUR)      | 487,324     | 705,383     |
| LUCKNOW                | 387,177     | 496,861     |
| POONA                  | 258,197     | 480,982     |

**Education.** The masses of the Indian population are illiterate, and education is distributed very unevenly between the sexes. Educational institutions are of two classes: recognized, and unrecognized. Recognized schools are those in which the course of study conforms to the standards prescribed by the Department of Public Instruction or by the universities or boards of secondary and intermediate education; they may be under public or private management. In 1950 the educational system of India included the following: 28 universities with 17,000

students; 470 art and science colleges with 260,000 enrolled; 282 professional colleges with 58,000 enrolled; 19,926 secondary schools with 4,709,000 students; 206,898 primary schools with 17,402,000 on the rolls; and 25,807 professional and special schools with 786,000 students. In addition, there were 9,071 unrecognized schools with 372,000 students. By 1955 there were 31 universities, compared with 16 in 1947 when India became independent.

Instruction in the universities is given in English except at the Osmania University, Hyderabad, where it is in Urdu. Among the older universities of India are Calcutta (1857), Bombay (1857), Madras (1857), Allahabad (1887), Banaras (1917), Mysore (1916), Patna (1917), Osmania (1918), Aligarh (1920), Lucknow (1920), Delhi (1922), and Nagpur (1923). Christian missions in India have instituted more than 35 schools of college rank. The missions also have a large number of primary, elementary, and approximately 150 secondary schools, as well as special schools in printing, agriculture, and other technical and handicraft fields.

#### ECONOMIC LIFE

**Agriculture.** India is primarily an agricultural country, and about one third of the population either tills the land or is engaged in operations directly connected with agriculture. About 50 per cent of the total area is under cultivation, and about 50,000,000 acres are irrigated. Irrigation projects have reclaimed the deserts of East Punjab, and parts of Rajputana, and even in the Deccan have saved the people from much suffering. There are about 60,000 miles of irrigation canals in India. About 30 per cent of the irrigated land is watered by wells and produces at least one-third more than canal-watered lands. The spread of canals, however, increases the possibilities of well-irrigation by adding to the store of subsoil water by seepage. Regions of severe drought are the western and southern sections of India that adjoin the Pakistani province of West Pakistan, western Bombay State, all of Rajasthan State, and southern Punjab State. Another area with little rainfall is the triangular tableland called the Deccan (see DECCAN, THE), situated in portions of eastern Bombay State, northwestern Madras State, eastern Mysore State, and southwestern Andhra Pradesh State.

There are two types of land tenure in India: *zamindari*, or large landholdings, and *raiyyatwari*, or small landholdings. Under *zamindari* tenure a proprietor or group of proprietors possesses estates of several hundreds or thousands of acres. These estates are taxed at about 30 per cent of their assumed rental. The *raiyyatwari* is taxed directly. Several provinces in 1949 enacted legislation to enable tenants to acquire land held by *zamindari*.

Food grains comprise more than three fourths of India's crop acreage and approximately the same proportion of the Indian diet. Food grains are grown chiefly in the states of Uttar Pradesh, Madras, Andhra Pradesh, Bihar, Madhya Pradesh, Bombay, West Bengal, and the Punjab. In 1950-51 India had 75,458,000 acres under rice cultivation with a production of 20,389,000 tons; 23,983,000 acres were devoted to wheat and 6,590,000 tons were harvested. Cotton production in 1950-51 amounted to 2,926,000 bales. Practically all of India's cotton is of the short-staple variety used in blanket, mattress, and upholstery manufacture. Other important crops with 1950-51 production figures were: sugar cane, 5,462,000 tons; groundnuts (peanuts), 3.33 million tons; and jute, 3,292,000 bales. Other crops are sesame, rape and mustard, flax, tea, coffee, tobacco, and rubber. India produced 22.5 million tons of rice in 1953 and 27.1 million tons in 1954.

Although Hindus do not eat beef, India has more than 200,000,000 cattle and buffaloes. Cows produce bullocks for draft purposes, and a little milk; buffaloes are used mostly for milk production. Some progress

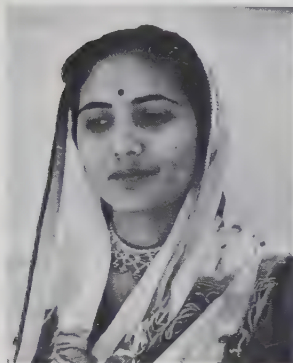




PHILIP GENDREAU  
**Sheep herder**



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**Sheep graze on a hilly river bank on frontier of India**



B. G. DAVIS  
**High caste Hindu**



PAN AMERICAN AIRWAYS  
**A Hindu bride travels in a curtained, ox-drawn carriage**



INDIA INFO. SERV.  
**Darjeeling peasant**



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**Peak of Kanchenjunga Mountain is visible from Darjeeling**



B. G. DAVIS  
**Brahmin**



B. G. DAVIS  
**Hindus prepare for bathing as part of holiday ceremony**

has been made in cattle breeding and dairy improvement. The annual production of Indian wool is estimated at about 55,000,000, exports of which go chiefly to Great Britain and the United States. The chief wool-producing areas are in northwest India.

India has extensive forests, but is forced to import large quantities of timber. The forests are classified as reserved (intended to be permanently maintained for the supply of timber or for the protection of water supply), protected, and unclassified. There are about 84,000 square miles of forests, including 65,000 square miles of reserved, 4,000 of protected, and 15,000 of unclassified.

**Manufactures.** The two largest industrial activities of India are cotton and jute manufacturing. Cotton manufacturing is concentrated largely in Bombay, and jute manufacturing in Calcutta. The provinces of West Bengal, Bombay, and Madras are the most important areas of industrial activity. Other important industries are steel and iron smelting, silk culture and weaving, shawl and carpet weaving, wood carving, and metalworking. In southern India, where sandalwood is grown, jewel cases and boxes are enriched with carving of finest detail and finish. Colored lac gives the rich color effects which are typical of Indian wood work. Teak, shishaw, deodar, ebony, walnut, jun, nim, and Madras redwood are used for ornamental work. Many of the beautiful varieties of Indian textile work have disappeared in competition with the power loom. Formerly the Indian craftsmen were unequalled in the weaving of cotton, wool, and silken fabrics. The textile industry is still the widest in extent in India. Next to weaving, the metalworking industry employs the greatest number of craftsmen. Copper and brass are the most widely used metals. Ornaments of gold and silver are delicately and elaborately worked and are unique in their barbaric designs.

Among the more recent and rapidly growing industries of India is steel, which has an annual capacity of 1,264,000 tons; production in 1949 was estimated at 925,000 tons. In the same year there were about 10,400,000 cotton spindles and 203,000 looms. Sugar-processing mills produced 1,000,000 tons of refined sugar in 1948-49. Increased production of sugar is due in part to technological improvement in the processing at the mills, which have a rated capacity of 1,500,000 tons a year. Cement and paper production, also, are the results of recent development. Among other industries are those producing paint, chemicals, soap, matches, nylon, and soda ash. In 1949 there was increased production of such items as Diesel engines, electric motors, transformers, dry cells, refractories, and sewing machines.

**Minerals and Mining.** India's mineral wealth is considerable and includes coal, petroleum, gold, salt, lead, building materials, asphalt, manganese, iron ore, copper, silver, mica, thorium, tin, ilmenite, chromite, and magnesite. More than 30,000,000 tons of coal are produced each year, some 450,000 tons of manganese ore, about 2,500,000 tons of iron ore, about 65,000,000 imperial gallons of gasoline, and the world's largest output of mica. Gold production has declined because of the difficulty of mining at the 8,000-foot depth in the Kolar fields where the vein is found. Thorium, the radioactive element used in atomic fission, is found in southwest India in the former feudatory state of Travancore.

**Transportation and Communication.** Railroads in India are largely state-owned, and have a number of different gages; of the 33,885 miles of railways in operation in 1948, less than half were standard gage. The railways are the largest single employer in India, with almost 850,000 persons on the payroll. Railways carry 80 per cent of the freight and 70 per cent of the passenger traffic of India. A renovation project, started after World War II, achieved part of its aim in 1949 when the bottleneck caused by worn-out equipment was eliminated. The all-India rail

link with Assam (by-passing East Pakistan) opened to restricted freight traffic in December, 1949. India acquired some 800 new locomotives in 1949-51.

There are approximately 260,000 miles of roads in India, but only about 20,000 miles are suitable for motor transportation; most of the improved roads are single-track asphalt roads with dirt bullock cart roads as shoulders. The majority of the roads in India are dirt bullock cart roads, deep in either mud or dust. Some 4,000 vessels in foreign trade annually put in at India's ports. About 75 per cent of India's trade passes through five seaports—Bombay, which has one of the world's largest harbors; Cochin, Calcutta, Madras, and Vizagapatam. Coastal steamers operate among the ports. Indian shipping tonnage increased to 396,000 tons in 1949. India is well served by air transport. Most of the large cities and towns are linked by air routes, and there is service to Great Britain, Australia, and the United States. Bombay and Calcutta are the chief international airports. Domestic air lines flew nearly 15,000,000 miles in 1949. Telephone and telegraph service are state owned and operated. In 1949 there were some 97,000 miles of telegraph lines, and about 114,000 telephones.

**Commerce.** The commerce of India consists largely of an exchange of raw materials and minerals for manufactured products and some foodstuffs. Great Britain is the leading market for exports and principal source of imports, with the United States second. Trade with Pakistan, which had been the third most important source of imports and second most important market, declined rapidly in 1949. India's total imports in 1949 amounted to \$1,473,000,000, and exports to \$1,207,000,000. The principal exports are jute and jute products, tea, cotton piece goods, hides and skins, minerals, and raw cotton; the principal imports are raw cotton, petroleum products, chemicals, drugs and medicines, machinery, and dyestuffs. In poor crop years, India is forced to import considerable quantities of rice and wheat.

#### GOVERNMENT OF INDIA

**British Government.** The Government of India Act of 1935 and subsequent acts of 1936 and 1937 established 17 provinces in British India. Before the partition of 1947 there were 11 major provinces under British governors, called governors' provinces, and six lesser provinces headed by chief commissioners, called chief commissioners' provinces. Burma was separated from British India on April 1, 1937. Two new provinces were created in 1936—Sind, which was separated from Bombay Province, and Orissa, which was separated from the Province of Bihar and Orissa.

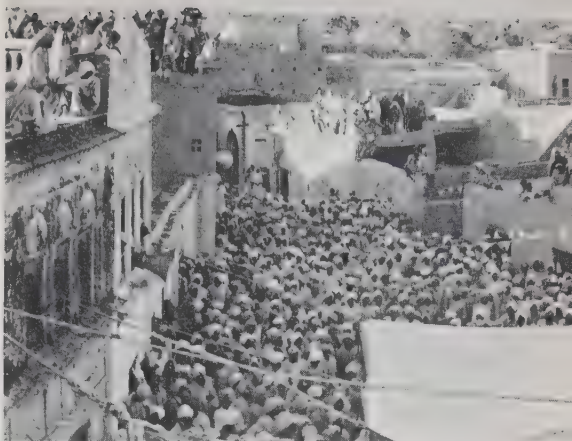
The 1935 act contemplated the establishment of a federation which would include not only the 17 provinces but also the native states acceding to the plan. For various reasons the federation plan never went into effect, and after the outbreak of World War II the scheme was dropped. Hence, throughout the war period India remained separated into two main sections—British India, and the areas under the numerous princes and petty chiefs, with a British viceroy and governor general over all.

Each of the 11 governor's provinces was headed by a British governor appointed by the Crown. The provinces of Madras, Bombay, Bengal, the United Provinces, Bihar, and Assam had legislatures of two chambers, each with a Legislative Council and a Legislative Assembly, while the Punjab, the Central Provinces and Berar, the North-West Frontier Province, Orissa, and Sind had only the Legislative Assembly. In the six states with bicameral legislatures the Legislative Council was of varying composition, with a few members always being nominated by the governor while the rest (except in Bengal and Bihar, where part were chosen by the Legislative Assembly) were elected by a cumbersome system which gave





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**Modern Hindu Women**, free of the old religious restrictions, are aiding in the development of India



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**Villagers of Bahadarpur** crowd the streets and house tops to welcome native hero of a Sikh regiment



B. G. DAVIS  
**Barges Pass Calcutta** on the Hooghly River, a branch of the Ganges emptying into Bay of Bengal

**The Steel Industry** in India reached its highest level of production during years of World War II

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PAN AMERICAN AIRWAYS  
**Beautiful Marble Palaces** set in Pichola Lake are on the western borders of the city of Udaipur in Rajasthan



B. G. DAVIS  
**Common Sight in India** is the sidewalk barber who sets up his open-air shop on busy city street

## India

representation to racial and religious minorities. The legislative assemblies were elected for five years but might be dissolved sooner. The Legislative Council was a permanent body but about a third of its members retired every third year. The provincial legislatures had only limited powers. The governor had a Council of Ministers chosen from the legislature.

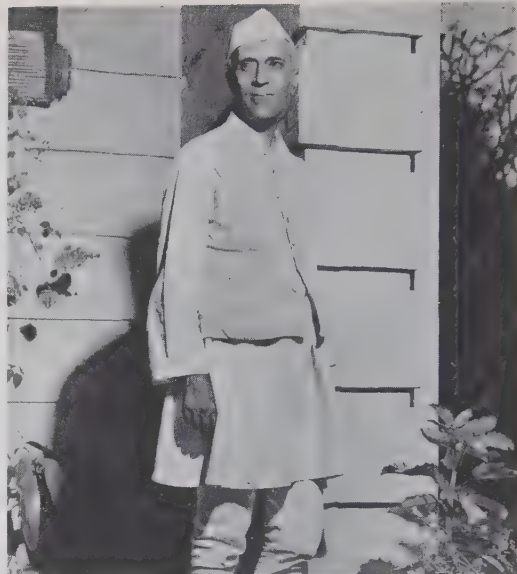
The six chief commissioners' provinces had no legislatures; they were governed by chief commissioners responsible to the governor general.

The 1935 act also set up a central government for British India. The Indian Legislature consisted of the governor general, the Council of State, and the Legislative Assembly. The Council of State consisted of 58 members, of whom 32 were elected and 26 were nominated, including the officials. The Legislative Assembly had 141 members of whom 102 were elected and 39 were nominated, including officials. The legislature had a broad field of legislative authority but its actions were not binding on the governor general, who could disallow laws passed and even enact legislation by his own authority. The governor general was assisted by a council of 15 appointed by the Crown; he was responsible to the secretary of state for India and Burma in the British Ministry in London.

For purposes of local administration British India was divided into 230 districts, each headed by a collector-magistrate or deputy-commissioner. This official was the chief magistrate, and as such exercised more or less control in every department except the judicial. In 1940 there were 756 municipalities which had an aggregate population of about 22 million. In all larger towns and in many smaller places the majority of the members of the municipal committee were elected by the taxpayers.

**New Government of India as of 1949.** The constitution of the new state of India was adopted on October 2, 1949, to take effect on January 26, 1950. The new constitution abolished untouchability and enumerated a detailed list of democratic rights. Noble titles were abolished except for those of the hereditary princes guaranteed by covenants with the central government. The country was organized on federal lines. The government has integrated the states more closely with the Indian Union.

The head of the Union is an elected president who has the executive power, which is administered with the advice of ministers responsible to the parliament. The president is elected for 5 years by an electoral



Prime Minister Nehru of India

MARGARET BOURKE-WHITE. © LIFE

college consisting of all the elected members of parliament and of the state legislative assemblies. The parliament of the Union consists of the president and the Council of the States and the House of the People. The upper house, the Council of the States, consists of not more than 250 members who are elected indirectly; representatives of each state are elected by the state legislature. The House of the People, the lower house, consists of not more than 500 members, who are elected by the voters of the states. The Council of the States is not liable for dissolution, but one-third of the members retire every second year. The normal life of the House of the People is 5 years.

The Union as of 1949 comprised 28 states. The constitution contained a provision for the establishment or admission of new states. Each state corresponding to a former governor's province had a governor appointed by the president for five years. Each state corresponding to a former Indian state had a rajpramukh at its head. The states had legislatures of either one or two houses. The constitution enumerated the various matters over which the Union parliament and the state legislature had jurisdiction. In November 1956 the states of India were reorganized according to linguistic patterns. Fourteen states and six centrally administered territories were created. In area the reorganized state of Madhya Pradesh is the largest; Kerala state is the smallest. Uttar Pradesh has the largest population and Assam the least. Kerala state leads all others in density of population with 908 persons per square mile.

The Federal Court of India is the highest supreme court in respect to matters involving constitutional issues. Below the supreme court are the state high courts and below them are the inferior courts of each state, such as the courts of session and the courts of magistrates.

**Army and Navy.** Upon the partition of India, the armed forces were divided between India and Pakistan, the former receiving about two-thirds, the latter one-third. The Indian army is in the process of reorganization. The army has been completely nationalized, and only a small number of British officers, mostly in technical branches, have been retained. The fleet includes a cruiser, 3 destroyers, 4 frigates, and several other ships. The government has undertaken a program to expand the navy. India also has several fighting air squadrons and a transport squadron.

### POLITICAL DIVISIONS OF INDIA\*

| STATE                                       | AREA<br>SQ. MI. | POPULATION<br>(1951 Census) |
|---------------------------------------------|-----------------|-----------------------------|
| Andhra Pradesh . . . . .                    | 110,250         | 32,200,000                  |
| Assam . . . . .                             | 84,924          | 9,000,000                   |
| Bihar . . . . .                             | 67,830          | 38,930,000                  |
| Bombay . . . . .                            | 188,240         | 47,800,000                  |
| Jammu and Kashmir . . . . .                 | 92,780          | 4,400,000                   |
| Kerala . . . . .                            | 14,980          | 13,600,000                  |
| Madhya Pradesh . . . . .                    | 171,200         | 26,100,000                  |
| Madras . . . . .                            | 50,170          | 30,000,000                  |
| Mysore . . . . .                            | 72,730          | 19,000,000                  |
| Orissa . . . . .                            | 60,140          | 14,600,000                  |
| Punjab . . . . .                            | 46,616          | 16,000,000                  |
| Rajasthan . . . . .                         | 132,300         | 16,000,000                  |
| Uttar Pradesh . . . . .                     | 113,410         | 63,200,000                  |
| West Bengal . . . . .                       | 33,279          | 26,160,000                  |
| <b>CENTRALLY ADMINISTERED<br/>TERRITORY</b> |                 |                             |
| Manipur . . . . .                           | 8,620           | 577,635                     |
| Tripura . . . . .                           | 4,049           | 639,029                     |
| Himachal Pradesh . . . . .                  | 10,600          | 983,367                     |
| Delhi . . . . .                             | 578             | 1,744,072                   |
| Andaman and Nicobar Islands . . . . .       | 3,143           | 30,971                      |
| Laccadive and Amindive Islands . . . . .    | 80              | 20,000                      |

\*As of Nov. 1, 1956.



**Feudatory States.** The states acceding to Pakistan retained much of their former British-ruled character under Pakistani control. In India, however, all the 566 states except Mysore, Hyderabad, Kashmir, Manipur, and the Khasi Hill states were integrated with the Indian government under one of three forms. These were: (1) merger with adjacent provinces, (2) transformation into centrally administered areas, and (3) grouping with other states in unions. Thus 215 states, with an area of more than 100,000 square miles and a population exceeding 17,500,000 were merged with various provinces; 27 states, with more than 27,000 square miles and a population of about 3,000,000 came under direct administration by the Indian government; and 304 states, with more than 236,000 square miles and a population of about 37,600,000 were merged into six unions. These unions were Rajasthan, Patiala, Vindhya Pradesh, Madhya Bharat, Saurashtra, and Travancore-Cochin. The centrally administered states were grouped into five divisions: Himachal Pradesh, Cutch, Bilaspur, Bhopal, and Rampur. Formerly the states under Pakistani and Indian rule, subject to British administration, were governed directly by the British viceroy or by various agencies. The chart in the preceding column lists the present states of India and their populations according to the 1951 census.

### HISTORY

**Prehistory and Earliest History.** The study of the Pleistocene prehistory of India is still in its beginning stages. Essentially, it is known that India was a border province in which several of the great "paleolithic" traditions overlapped. Tool types of the two early west Eurasian traditions, the coreiface and the flake, are found as far eastward as the Madras coast. On the other hand, it has been discovered that tools of the southeast Asian chopper-tool tradition have been isolated as far westward as the Indus basin. At one site in this latter area, a blending of flake- and chopper-tool traditions has been noted. Later in the Pleistocene, the blade-tool tradition probably reached India, but details of this are unclear. Micro-liths have been published from Indian sites, but even a general picture of final Pleistocene or early post-Pleistocene times in India is unavailable.

The earliest finds of the village type of economy in India come from the Indus Valley and Baluchistan in the far northwest. By 1946 McCown and Piggott had accounted for two stages of village materials probably related to those of early southern Iran with dates previous to c. 2750 B.C. Although few details of these materials are yet available, it is sufficiently clear that the Harappan stage, which follows them, was not a natural outgrowth from them. The Harappan complex is best known from the work of Mackay, Majumdar, Marshall, and Wheeler, on such sites as Harappa, Chanhu-Daro, and Mohenjo-Daro. The Harappan is now known to have been a third great center of early civilization and urbanization, comparable to Mesopotamia and Egypt. (See *ARCHAEOLOGY, India and Pakistan*.) The ruins of Mohenjo-Daro show the site of a once great city—with public buildings including a bath and sophisticated two story houses, all of baked brick—surrounded by a fortification wall. Writing (still undecipherable) was known. There was competent work in metallurgy and the arts. Trade connections with Mesopotamia in the Early Dynastic and Akkadian periods have been demonstrated. However these Indus Valley cities were no pale reflection of Mesopotamian civilization—their traditions were their own. They must have come into existence by 2700 B.C. and probably fell before 2000 B.C. Two succeeding archaeological stages, the Jukhar and Jungar, are poorly known. Nor is it yet understood what brought about the downfall of the Harappan civilization itself, but the Vedic hymns speak of the conquest (by the Aryas or Aryans) of great forts. It may thus have been the

Indo-European speaking peoples who called themselves Aryas (and from whence comes our much perverted term "Aryan") who brought an end to the Indus Valley cities.

LINDA BRAIDWOOD

**The Vedic Age.** Sometime between 1800 B.C. and 1200 B.C. a group of tribes belonging to the Indo-European family of peoples invaded North Western India. The invaders came by way of Afghanistan, but beyond that it is impossible to trace their wanderings. The members of these tribes called themselves ARYANS and spoke an archaic form of Sanskrit. During this early period we find the Aryans settled east of the Indus River in the territory known as the Punjab. The only source of information which we have for this period is the Rig Veda, the oldest Sanskrit text. The contents of the Rig Veda are almost altogether religious, and therefore we get comparatively little historical information. It is impossible to write a connected political narrative of those times. Yet on the basis of the material which we have we can form a fairly good idea as to the life of the Aryan tribes. It is clear that they were still seminomadic, their main occupation being cattle-raising. Cattle was their most prized possession, although they knew and practiced agriculture. They had villages, but cities were apparently unknown to them. As a rule a tribe was headed by a hereditary king, but republics also existed. Three social subdivisions existed, the priests or Brahmins, warriors or Kshatriyas, and the commoners or Vaishyas. At this time, however, there was apparently no absolute barrier dividing these groups into hereditary castes. As a matter of fact, in only one very late passage of the Rig Veda is there a mention of what later became the fourth principal CASTE, the Sudras, who probably represent the non-Aryan part of the population.

The hymns of the Rig Veda show that there was as a rule a state of conflict between the Aryans and the aboriginal inhabitants of the land, who were called the Dasyus. These Dasyus, who were evidently of a darker skin-color than the invaders, can be identified with the Dravidians, who are now mostly settled in southern India. It is probably in this original distinction between the Aryan and the Dasyu that we have to look for the origins of the caste system.

The religion of the early Vedic Age can be described as a worship of the personified phenomena of nature. Virtually every deity represented some manifestation of nature. So, Indra, the most popular god of the period, represents the rains and the thunderstorms; Varuna, Indra's closest rival, is the god of the sun and of the sky. The gods are, on the whole, benevolent, but must be propitiated through sacrifices, and it is here that the role of the priests becomes increasingly more important, for only the priests know how to perform the sacrifice correctly. Life after death is pictured as a glorified continuation of the present existence. Virtually nothing is known regarding what happens to those who did not sacrifice to the true gods.

For the later Vedic Age we have additional information from other Sanskrit texts. In the first place we have the Samaveda, the Yajurveda and the Atharvaveda. These are collections of hymns, based almost altogether on the Rig Veda, but adapted to liturgical, sacrificial and magical purposes. We find in these texts some information which points to changes in the life of the Aryan tribes. It is evident that most of the tribes have migrated eastward. These are now settled in the territory between the Ganges and the Jumna rivers. The most important factor in social life is the tremendously increased role of the Brahman priests, along with which there goes a constantly increasing complexity of sacrificial ritual. We hear much less about the conflict between the Aryans and the Dasyus, who apparently had been absorbed into the social body under the name of Sudras. It is certain, however, that a lot of inter-marriage between Aryans and Dasyus had taken

place during the early period; and the later development of the caste system proceeds rather along occupational, and not racial, lines.

The Brahmanas and Upanishads, which are commentaries on the Vedas, give us more information on the last part of the Vedic Age (about 800 to 550 B.C.). We see that the expansion of the Aryan civilization is continuing. Kingdoms and cities are growing and the caste system is becoming more complex and rigid. In the Upanishads, especially, there appear indications of important religious changes. The ideas of transmigration of the soul after death and of the essential unity of the universe were expounded. But there is also ample evidence of the continuous growth of the sacrificial ritual and the increasing pretensions of the priestly caste.

GEORGE V. BOBRINSKOY

**Buddhist Period.** From 259 B.C., when the Mauryan king ASOKA was crowned at Pataliputra (near Patna), we begin to fit together a skeleton of history from relics in stone, earth, or clay, and from tablets, inscriptions, and coins collected and arranged by European research. Literary remains, few and widely scattered, are mainly contributed by Greek and Chinese writers. Alexander's expedition to the Hyphasis (Beas), 326 B.C., sheds light merely upon the history of the Punjab. In 302 B.C., Seleucos Nicator, whom Alexander left at Babylon, sent Megasthenes on a mission to Pataliputra; and Favian in A.D. 399, and Hsüan Tsang (629-645), went over the same ground, and extended their tours to other parts of India. Asoka's pillars and rock inscriptions (253-251 B.C.), found near Peshawar, in Junagarh, Katak, Ganjam, Rajputana, Delhi, Allahabad, and, in 1895, on the Nepalese frontier, indicate the far reach of his rule. His edicts prohibit the sacrifice of animals, order medical relief for man and beast, enjoin the planting of trees and sinking of wells, dwell with satisfaction on the peace and prosperity which prevail, and preach the virtues of liberality, piety, and religious toleration. They excite our interest in the state of India, but leave it unsatisfied. Architectural remains supply lists of dynasties and nothing more. The laborer's shovel disinters coins which tell the tragedy of vanished empire, but give no details of its rise and fall; and we catch mere glimpses of Indo-Bactrians, White Huns, and Scythians. Even in the small tract of country which came under the observation of Megasthenes, we hear of 117 principalities besides the Prasii, and it is evident that no dynasty had rule over any extensive portion of India.

The Mauryan rulers at Magadha claim our main interest. From about 300 B.C. to the fifth century A.D. they maintained their authority and their language, Pali. They were succeeded by the Andras. But other dynasties—the Valabhis of Gujarat, the Rajput Chauras, the Chalukyas of Badami, and the kings of Kanauj—crowd upon the canvas, and assert claims to a pre-eminence which no historic facts can prove or refute. Recent researches forbid any reliance upon the Samvat era of Vikramaditya, counted from 56 B.C., or the Shake era (A.D. 78) of the Indo-Scythian king Kamiska (Kanishka), hitherto recognized as standpoints of early Indian chronology. Real history, in fact, remains a blank until the lurid light of Mahmud's destructive expeditions falls upon its pages.

**Mohammedan Period.** We are now upon firmer ground, and from A.D. 1001 onward there is abundance of material for history. Kings, as Nasir-ud-din, Baber, Humayun, wrote memoirs; foreign visitors, as Ibu Batuta, Sir T. Roe, Bernier, Tavernier, were entertained; and literary men, as Ferishta, Kufi Khan, Abul Fazl, were patronized and assisted. Between 1001 and the conquest of Delhi by Baber (1527) four kings claim special attention—Mahmud, Shabab-ud-din, Ala-ud-din, and Mohammed Tughlak. Mahmud's grandfather, a Turki slave, founded the dynasty of Ghazni (see GHAZNEVIDS) A.D. 961, and was succeeded by his son Sabuktegin. The neighbor-

hood of the Ghaznevids was resented by Tejpal, rajah of Lahore, but with disaster to himself; and when Sabuktegin found it necessary to chastise him for breach of treaty, the Hindu states who joined forces against the invader brought down upon themselves the loss of the trans-Indus districts. On the death of Sabuktegin, Mahmud led a succession of expeditions against the Indian principalities, conquering (1008) Kanauj, Delhi, Ajmer, Gwalior, Ujjain, and carrying the spoils of Somnath to Ghazni (1024).

In the reign of Behram (1118), the men of Ghor overthrew the Ghaznevids; and in 1176, the Ghorian Shabab-ud-din, though he failed to subdue the Rajputs, brought under his sway Gujarat, Gwalior, Bengal, and the whole of Hindustan except Malwa. On his death (1206) Hindustan became detached from Afghanistan, and upon this unhappy country the stress and storm of the Moguls fell. Kutb-ud-din, whom Shabab-ud-din had left in command of his Indian forces, became king of Delhi, and founded the line of slave kings who ruled from 1206 till 1288. Of these, Altamash added Malwa to the Delhi kingdom (1226). The Turki house of Khilji (1288-1321) held the Mogul invaders in check; and the most famous of that line, Ala-ud-din (1295-1316), extended his sway down even to Madras. Thus the succeeding Tughlak dynasty (1321-99) held rule over a larger kingdom than had ever come under one crown, until the mad freaks of Mohammed Tughlak broke it into pieces. His projects of foreign conquest in the direction of China and Persia ended disastrously, impoverishing his treasury, and letting loose upon his defenseless subjects a host of unpaid soldiery. Taxes were collected with fire and sword; the inhabitants of Delhi were forcibly driven out to people Daulatabad, at a distance of 600 miles; Bengal and the Deccan revolted.

An important consequence of this misrule was the establishment in the Deccan of the kingdom of the Bahmini sultans of Kulbargah (1347), which broke up into the five principalities of Ahmadnagar, Bijapur, Bidar, Berar, and Golconda. The same causes also assisted the growth of the Hindu kingdom of Vijayanagar, founded about 1335 by two brothers of the Kuraba caste, which fell at Talikota (1565) under the combined attack of the five principalities mentioned above. Malwa and Khandesh revolted, and the capture of Delhi by Tamerlane (1398) completed the disruption, and left Hindustan a prey to anarchy and famine. So matters remained until Baber acquired Kabul in 1504, and invaded the Punjab, claiming it as part of the heritage of Tamerlane. In



THE BETTMANN ARCHIVE

**Baber Defeats Ibrahim Lodi at Panipat, 1526, as portrayed by the British artist, Ambrose Dudley**



1524 he gained a victory at Lahore, and two years later he defeated Ibrahim Lodi near Panipat, and occupied Delhi and Agra, ruthlessly putting to the sword all who dared to oppose him. Step by step he won back the revolted provinces of Gwalior, Mewar, Chanderi, and Bengal, but died at Agra (1530), in the midst of family quarrels and intrigues. His son and successor, Humayun, commenced a disastrous reign by resigning Kabul and the Punjab to his brother Camran. He then invaded Gujarat, and had just taken Champaner when tidings of the rebellion of Shir Khan in Bihar reached him. Returning to deal with this outbreak, he suffered a signal defeat at Kanauj (1540), and eventually fled to Amirkot (Umarkot). Later, he took refuge in Persia, then ruled by Shah Tamasp, leaving Shir Khan to establish himself and his descendants of the Sur line on the throne of Delhi. Shortly afterward, with the help of a Persian force, he captured Kabul and Kandahar, and invading the Punjab, had by 1555 recovered Lahore, Delhi, and Agra, when he met with an accident and died before his general, Bairam Khan, had finally crushed the resistance of Sikandar Sur.

**Akbar** was only 13 years of age when his father died, in 1556; but with the help of Bairam Khan he rapidly established his authority over Ajmer, Gwalior, and Lucknow. Able pilot, however, as Bairam proved himself amid these early shoals, his arrogant use of power disgusted **AKBAR**, who presently dropped him, and in 1560 took full command of the vessel of state. Rebellions in Hindustan were suppressed with the utmost vigor; while, partly by force of arms and partly by diplomatic matrimonial alliances, the Rajput chiefs, with the exception of Udaipur, were brought into friendly relations. Upon the subjection of Gujarat, Bengal, Kashmir, and Sind, which quickly followed, Akbar was able to give his personal attention to the Deccan, where the courage and diplomacy of Chand Bibi had foiled the endeavors of his generals. The sultana was murdered by a faction, and the emperor, having reduced the fort of Ahmadnagar and subdued Khandesh, returned to his capital, Delhi. His remaining years were clouded by the refractory conduct of his son Selim, and by the murder of Abul Fazl, author of the *Ayen Akbari*. He died in 1605, having established an Indian empire not merely on the foundations of military force, but upon sound principles of civil administration.

**Akbar's Successors.** Selim succeeded his father under the name of Jehangir, and reaped the fruits of his own unflinching conduct in the rebellion of his son Khusru, and later on in serious disagreements with another son, **SHAH JAHAN**. He showed vigor in carrying on the war with Mewar, but was less successful in the Deccan, where the Abyssinian, Malik Amber, had founded a new capital at Aurangabad, and had strengthened his position with the *rayats* by introducing a reformed revenue system.

Shah Jehan, the next emperor, was deposed by his son after a reign of thirty years. By his prudent administration he enriched India with various public works, among them being the splendid buildings of Delhi, the peacock throne valued at \$32,000,000, and the mausoleum at Agra to his queen, now so widely known as the **TAJ MAHAL**.

The long reign (1658-1707) of his successor, the bigoted and suspicious **AURANGZEB**, was in every direction disastrous to the kingdom of Delhi. His treatment of his brothers showed how little mercy his enemies might expect. Dara was put to death in 1659, Shuja was driven an exile into Arakan, and Murad was publicly executed after the farce of a trial. By his treatment of the widow and children of Rajah Jaswant Sing of Jodhpur he disgusted the Rajput princes, and in the military operations which ensued they and their people suffered cruelties which they never forgot. The Hindu subjects of the empire were excluded from office, insulated by the reimposition of the *jezia*, and aggrieved by interference



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**Akbar Receives Ambassadors in celebration of his triumph after submission of Bairam Khan, 1561**

with their social and religious customs. In the Deccan, Sivaji, at first nothing more than a leader of banditti, was founding a power which would presently measure swords with the emperors. In 1670 the Mahrattas offered the imperial provinces their choice between payment of *chowth*—one-fourth of the revenue—or plunder at the hands of their armies. Aurangzeb's cruel treatment of Sivaji's successor, and his conquest of Bijapur and Golconda—Mohammedan states that might have resisted the Mahrattas—left the field open for the latter. The emperor died at Ahmadnagar in 1707, leaving behind him universal discontent and desolation, and an empire crumbling to its fall. His son and successor, Bahadur Shah, drove the Sikhs out of Sirhind, and took their leader, Bandu, prisoner. Farokshir, who followed, inflicted further losses upon the Sikhs, many of whom he tortured with inhuman cruelty. On his deposition in 1719, insurrections ensued in all parts of the empire; and during the reign of Mohammed Shah, Asaf Jah established himself in the Deccan as an independent power.

The Mahrattas rapidly consolidated their strength under the Peshwas, and Mogul rule was but a phrase when **NADIR SHAH** seized the throne of Persia, and in 1738 invaded India. Delhi was taken, and, after a general massacre, its treasures were carried off by the destroyer. Recovery from such a blow was impossible, and before the death of Mohammed Shah in 1748, Ahmed Shah Durani had seized the Punjab, and was organizing those incursions which, while hastening the imperial downfall, inflicted upon the Mahrattas the crushing defeat of Panipat in 1761. Alamgir II witnessed a repetition of the horrors of Nadir Shah's descent, and with his assassination in 1759 the Mogul empire virtually passed away. From Shah Alam the East India Company, after the victory of Buxar, obtained the diwani of Bengal in 1765; and in 1771, weary of life at Allahabad under British protection,

he made his way to Delhi, emperor in name, Sindhia's prisoner in reality. In 1778 his eyes were put out by a Rohilla chief; and though again restored by the British to the imperial dignity, he died in 1806 without any real power or authority outside the palace. Delhi, with the surrounding country, was ruled in the name of his successor, Akbar Shah, until 1832, when it was annexed. After the mutiny in 1857, Bahadur Shah II, convicted of assuming the sovereignty of India, of murdering Christians, and of abetting revolt, was deported to Rangoon, where he died in 1862.

**British Occupation.** On Dec. 31, 1600, the London EAST INDIA COMPANY obtained a charter for the exclusive privilege of trading to all parts of Asia, Africa, and America beyond the Cape of Good Hope, eastward of the Straits of Magellan. In 1613 they established a factory at Surat under a *firman* granted by the emperor, that port being then the chief outlet from which the *hadj* was made to Mecca; and other positions were occupied at Calicut and Masulipatam. In 1661 Bombay was made over by the Portuguese as part of the dowry of Catherine of Braganza, in 1668 it was given over to the East India Company, and in 1685 the headquarters of the British traders were transferred from Surat. In 1689 permission was given by Aurangzeb's officers for the purchase of the site of Calcutta, and in 1715 Bengal became a separate presidency.

The year 1698 was a turning-point in the history of the London company. The state wanted a loan of two millions, and, as an inducement, the subscribers were allowed to convert their shares into a joint stock under the name of the English East India Company. William III granted a charter and the celebrated court of directors and general court of proprietors were then constituted. In 1708 the London company and the English company combined under the title of the United East India Company. Extensions of its charter were from time to time obtained, and when, in 1765, Shah Alam added the *diwani*, progress was rapid. The Battle of Plassey in 1757 had insured military supremacy. The company now took over the financial control, leaving the judicial administration with the nawab. But the misery and disorganization which the occurrence of famine brought to light led them, in 1772, to exchange commerce for territorial sovereignty. The Regulating Act of 1773 provided the machinery of government needed for this revolution; and under it Warren Hastings, the first governor general of Fort William in Bengal, took his seat in council on Oct. 20, 1774. Pitt's Act of 1784 established the control of the board of commissioners for the affairs of India.

In 1813 trade was thrown open to licensed persons, and "the undoubted sovereignty of the crown" over the territories acquired in India was reserved; possession of those territories was, by a special act, guaranteed for a term of twenty years. The Charter Act of 1833, which sanctioned possession for a further period of 20 years, recognized the imperial character of the company's rule by appointing Lord William Bentinck, then governor general of Bengal, to be governor general of India. On the suppression of the mutiny of 1857, the powers and territories of the company were transferred to the Crown by the Government of India Act of 1858, and at the same time the Secretary of State's Council was created. In 1860 the separate European army of India was abolished, and in 1877 Empress of India was added to the older titles of Queen Victoria. See SEPOY MUTINY.

**British-French Conflict.** The process by which the company's rule was built up must now be explained. The first great forward movement was taken in Madras, where Fort St. George, founded in 1629, had in 1653 risen to the dignity of a presidency. In 1672 the French purchased Pondichéry. Its proximity to Madras quickly brought the French and English companies into collision. Thus it came about that, in

1746, Admiral Labourdonnais, and Dupleix, the governor of the French possessions in India, seized upon Madras, which was not restored until the peace of Aix-la-Chapelle in 1748. Hostilities soon broke out again. The occasion was a quarrel between native powers as to the succession to the vicereignty of the Deccan on the death of Asaf Jah in 1748, the two claimants being Muzaffar Jung, the elder son, whom his father had nominated for his successor, and Nazir Jung, the younger son. The dispute involved also the nawabi of the Carnatic, for which Chanda Sahib and Mohammed Ali were rivals. Both sides invoked European aid; and while the French espoused the cause of Muzaffar Jung and Chanda Sahib, the English lent their support to the other claimants. As the result of a long series of operations, the French were completely worsted, Chanda Sahib perished, and Mohammed Ali was left master of the Carnatic. It was during these operations that the name of ROBERT CLIVE was first heard, and his brilliant defense of Arcot (1751) gave promise of the great things he was to accomplish later on. In 1756 came the Seven Years' War with France, and a fresh conflict between the rival companies. At the outset the French general, Lally, obtained some striking successes, but his siege of Fort St. George had to be raised, the northern Circars were conquered by Forde, and in January, 1760, Lally's army was defeated by Eyre Coote at Wandiwash. The victory of the English was decisive, and in 1761 Pondichéry surrendered.

Shortly after these events the English were threatened from a new quarter. Hydar Ali, who commanded a force sent by the Hindu ruler of Mysore to take part in the siege of Trichinopoly, deposed his sovereign, and proceeded to make large conquests in the Carnatic. Against him the English agreed to aid the nizam; but Hydar contrived to break up the alliance, and in 1769 threatened Madras. His attack was averted only by mutual restitutions. At the outbreak of war between France and England in 1778, the French were expelled from Pondichéry and Mahé. The latter place being in Mysore territory, Hydar found an excuse for attacking the English, who failed to obtain any signal advantages over him. He died in 1782, but his son Tipu continued the conflict until his defeat and death at Seringapatam in 1799. Hindu rule was now re-established in Mysore, while the outcome to the English was the acquisition of Canara, Coimbatore, Salem, and part of two other districts by the Madras government. Other districts were awarded to the nizam, two of which, Bellary and Cuddapah, were later on, by exchange, incorporated in the presidency. The long-continued hostilities exhausted the company, and it was found necessary to claim from the nawab his share of the expenses, as well as repayment of loans made to him. At length, all other arrangements having failed, the Carnatic was annexed, and the titular dignity of nawab alone remained to the grandson of Mohammed Ali. Finally, the family were pensioned, and the title of Prince of Arcot conferred upon its representative. By these means the presidency of Madras was built up, and the states which had assisted the company, Travancore and Cochin, were brought into the British protectorate.

**Robert Clive.** While the events just narrated were occurring in the south, the company's factory in Calcutta was extending its possessions, and at a critical moment Madras was able to send Clive to the relief of the sister presidency. The peril came from Suraj-ud-Daula, governor of Bengal, who in 1756 descended upon Calcutta and thrust the British residents into what was afterward called the "Black Hole," where 123 of them perished in a single night (see CALCUTTA). On Jan. 2, 1757, Clive relieved the town, and on June 23 won the victory of Plassey. Meer Jaffir was installed in the place of Suraj-ud-Daula, and from his successor, Meer Kasim, the company obtained Burdwan, Midnapur, and Chittagong. In





THE BETTMANN ARCHIVE

**At Battle of Plassey in 1757, Prince of Bengal made first use of elephants as living gun carriers**

1764 Shuja-ud-Daula, vizier of Oudh, aided by the emperor Shah Alam, threatened Patna; but the British, under Major Munro, defeated him in a decisive battle at Buxar. This victory laid Oudh at the feet of the company, and enabled Clive, on his return to India in the following year, to secure from the emperor the diwani, or fiscal administration, of Bengal, Bihar, and Orissa, with the jurisdiction of the Northern Circars.

In 1772 WARREN HASTINGS was placed at the head of the British administration, and in the following year he lent the vizier of Oudh the help of British troops to crush the Rohillas, who, in the reign of Mohammed Shah, had established themselves in Rohilkhand. The quarrel arose out of the failure of the Rohillas to pay to the vizier the sum stipulated for his aid against the invading Mahrattas; and, backed by the English, the vizier triumphed. Faizulla Khan, the Rohilla leader, was, however, recognized as chief of Rampur under a British guarantee; and when, in 1801, the vizier ceded Rohilkhand to the company, Rampur was continued in possession of the Afghan family. After the Rohilla War, Hastings plundered Chait Sing of Benares, and extorted a heavy fine from the Begum of Oudh, for which and other acts he was impeached before Parliament in 1788. The company was now brought into close relations with Oudh, which they hoped to make a buffer state between their Bengal possessions and the territories beyond, so constantly swept by the Mahrattas. The vizier, however, was a weak ruler, his successors were equally unable to maintain order or to defend Oudh, and in 1836 it was found imperative to assume administration of the country, and Wajid Ali was pensioned.

**Expansion of British Control.** The policy of setting up buffer states having failed, it now became necessary to bring the Mahrattas to order; and Lord Lake, having in 1803 inflicted defeat upon them, entered Delhi and took the king under his protection. Considerable tracts of land to the west of the Jumna were annexed; but, as already related, the Delhi districts were, until 1832, administered in the Mogul name. By 1808 British authority had reached the Sutlej; before the end of that year the Nepalese were driven out of Sikkim, Kumaon, Garhwal, and Dehra Dun; while to the south, the Sagar and Narbada territories were wrested from the Mahrattas. Thus, step by step, the company acquired the provinces now known as Bengal, Assam, the United and Central Provinces.

While Clive and Warren Hastings were extending the company's rule in the south and east, there was a pause in the west, during which the Mahrattas first extended their power, and then split up into factions after the battle of Panipat. From 1629 to 1687, when

they were moved to Bombay, the headquarters of the company's trade were at Surat. In 1664 Sivaji attacked this city, but was beaten off. This was the first exchange of blows between the merchants and the Mahrattas.

The founder of what is called the Mahratta nation was Sivaji, son of a soldier in the service of Bijapur. After gaining victories which induced the emperor to recognize him as rajah, he died in 1680, bequeathing to his followers that spirit of plunder which he had excited. To the successors of Sivaji the legacy was of small value, the real power passing into the hands of the peshwas. Of these, Baji Rao reduced Malwa, overran Bundelkhand and Hindustan, and from Delhi exacted the cession of *chauth* over the whole empire. With him the British governor of Bombay entered into a commercial treaty; and on the succession of his son, Balaji Rao, a further alliance was made in 1755 for the suppression of piracies, and for the exclusion of the Dutch from trade within the Mahratta dominions. Balaji Rao was succeeded by Madho Rao Ballal, who died in 1772, at a time when Sindhia, having recovered from the disaster of Panipat, was resuming operations in Rohilkhand and at Delhi. Raghoba seized upon the peshwaship and applied to the British for help against his rivals, supported by Sindhia and Holkar. From these dissensions the British gained Bassein, Salsette, and other islands on the Bombay coast. Meanwhile, the alliance with Raghoba was dissolved under the orders of the supreme government, only to be renewed in 1778 by another treaty. Raghoba was promised the assistance of a British force; but the troops were defeated and compelled to sign the ignominious convention of Wargaon (1779). The convention was disavowed at headquarters, and hostilities were renewed. But the English detached Sindhia, and under his guarantee peace was restored once more by the treaty of Salbai in 1782.

**Mysore Wars.** Then ensued the Mysore wars, into which the Mahrattas were partially drawn. Fortunately, however, the great chiefs could not agree among themselves, and in 1801 they were at each other's throats in a fierce struggle for supremacy. In 1802 Sindhia came to the aid of the peshwa, Baji Rao II; but the combined forces were defeated with great slaughter by Holkar, who then advanced upon Poona. At the end of the year Baji Rao accepted from the British the treaty of Bassein, which brought the court at Poona into subsidiary relations with the company. Holkar retired to the Punjab, while Sindhia formed a league with Berar to defeat the treaty. But the British victories at Assaye, Gawalghar, Laswari, and Delhi reduced Gwalior, Indore, and Berar to subordinate allies. By treaties with Sindhia in 1803, and with Holkar in 1805, large accessions of territory in central India accrued to the company, the peshwa, and the nizarn. In 1815 disputes between the peshwa and Baroda compelled the Bombay government to interfere, and to force on him the treaty of Poona (1817). When, a few months later, the Pindari War broke out, the peshwa suddenly attacked the British residency, but by the Battle of Kirki was reduced to such straits as to be glad to retire to Bithur on a pension granted by the company.

With the fall of the peshwa the Mahrattas ceased to be a nation, and the Bombay Presidency at once attained great size, though Sind was not added till 1843. Several native states, Baroda, the Kathiawar chiefships, and numerous other small principalities in Gujarat and the Deccan, were preserved under British protection. Satara was annexed in 1848.

**Expansion of the Indian Empire.** The events which added Burma and restored the Punjab to the Indian Empire must now be traced. Mention has already been made of the Sikhs, a sect founded in the 16th century by Vaba Nanak, welded in the next century by Guru Govind into a military organization, and enrolled in the ranks of martyrs by the Moham-

medan kings of Delhi. The withdrawal of Ahmed Shah from India left Ranjit Sing free to extend his authority over the separate principalities north of the Sutlej; and the British company, hoping to see the Punjab formed into a strong and friendly buffer state, gladly recognized his sovereignty in 1809. On his death in 1839 anarchy ensued, and the uncontrolled Sikh army committed aggressions upon British territories which led to the first Sikh War, and the British victories of Mudki Ferozshah, Aliwal, and Sobraon in 1845-46. The country between the Sutlej and the Beas was then annexed, and shortly afterward a council of regency was formed to govern the Punjab in the name of Dhulip Sing. In 1848 two British officers were murdered at Multan, and the Khalsa army again broke out. The indecisive battle of Chilianwala in 1849 was followed by the victory of Gujarat, and the whole province was annexed to British India.

**Acquisition of Burma.** The events which led to the annexation of Burma were more gradual. Not long after the cession of Chittagong to the company in 1760, the Burmese invaded Arakan, and, after their conquest of it, complained of the action of Arakanese rebels who found refuge in Chittagong. No redress being given, they violated British territory; whereupon Lord Amherst declared war, and Rangoon was taken in 1824. On the conclusion of peace, in 1826, Arakan and Tenasserim were annexed, and a resident was appointed to the court of Ava. In 1852, Lord Dalhousie being governor general, reparation was demanded for injuries inflicted upon British subjects; and, on its refusal Rangoon was again taken, this time to be retained. No sooner was peace restored than the old difficulties recurred; and matters finally reached a crisis when, in 1885, the treatment of the Bombay Burma Trading Corporation led Lord Dufferin to send a force across the border. The forts of Ava were captured, and Mandalay occupied (Jan. 1, 1886). Upper Burma was declared to be a part of the British dominions, and in 1897 Upper and Lower Burma were formed into one province under a lieutenant governor. See **BURMA**.

**Bengal Governors.** Between Warren Hastings in 1774 and Lord William Bentinck in 1828, there were 11 occupants of the post of governor general of Bengal, a number of whom may be briefly mentioned. The name of Lord Cornwallis is famous for the introduction of the Permanent Settlement in Bengal—a measure of doubtful expediency—for administration reforms, and for his steady endeavor to resist the increase of territorial acquisition. Lord WELLESLEY held, on the contrary, that the assumption of imperial responsibilities could alone secure peace and order. After the fall of Seringapatam he without hesitation annexed part of Tipu's dominions. Between 1798 and 1805 he added to the company's rule the Carnatic, several districts round Allahabad, parts of Bundelkhand, Katak, and Balasore, Ahmednagar, the Delhi territory, and the Doab between the Ganges and the Jumna.

The Marquis of Hastings, through successful wars against the Nepalese, Mahrattas, and Pindaris, added Kumaon, Dehra Dun, and Simla to British rule, consolidated Bombay, and pacified western and central India. Lord Amherst (1823-28) extended this protectorate across the Bay of Bengal into Burma, and added Singapore, Malacca, Assam, Arakan, and Tenasserim to the company's possessions.

In 1828 Lord William Bentinck succeeded as governor general of Bengal, and in 1834 became the first governor general of India. He devoted his term of office to internal reforms. In the short interval before his successor (Lord Auckland) arrived, Lord Metcalfe in 1835 gave India the liberty of the press. Lord Auckland's rule (1836-42) was memorable for the disastrous Afghan War, when the army left Kabul after an occupation of two years, and a single survivor (Dr. Brydon) reached Jalalabad in 1842. In 1839 Aden was annexed to Bombay.

Lord Ellenborough (1842-44) annexed Sind, and avenged the disaster at Kabul by a recapture of that city. Before his recall he also crushed the mutinous troops of Gwalior in the battles of Maharajpur and Panniar, thus removing a source of danger from the path of his successor, Lord Hardinge (1844-48), who carried to a successful close the first Sikh War.

**Consolidation of the Empire.** Lord DALHOUSIE held office from 1848 to 1856. By his conquests of the Punjab in 1849 and of Pegu in 1852, and by his annexation of dependent native states, including Oudh, he consolidated British dominion. He introduced railways and telegraphs, placed Bengal under a local governor, and established legislative councils and a system of public education. After his retirement in 1857 occurred the mutiny, which was suppressed under his successor, Lord Canning. To him was due also the grant of *sunnuds* of adoption, by which the native states were assured against annexation and admitted into the higher position of subordinate allies of the British government.

Lord Elgin, appointed in 1862, died in 1864; and upon Lord Lawrence, who had done so much to save British India in the mutiny, devolved the task of correcting defects in the military system and of restoring the finances. Railways and irrigation were pushed forward as far as funds allowed, and the question of tenant rights in Oudh and the Punjab was dealt with. Lord Mayo succeeded in 1869, and received in *darbar* at Ambala the Ameer Shere Ali.

**Establishment of British Sovereignty.** On the assassination of Lord Mayo by a convict in the Andamans (1872), Lord Northbrook became viceroy. Considerable reforms in the financial system marked his rule, and he successfully grappled with a serious famine in Bihar. Lord Lytton (1876-80) carried through the Afghan wars, caused by the reception of a Russian embassy at Kabul and the intrigues which arose after that event. (See **AFGHANISTAN**.) In the year after the Mutiny, an "Act for the Better Government of India" (1858) ended the long career of the British East India Company and transferred all the territories under its control to the British Crown. The governor general was replaced by a viceroy representing the British sovereign, and a secretary of state for India became one of the most important ministers of the British government. Almost 20 years later, on Jan. 1, 1877, sovereignty was definitely established when Queen Victoria was proclaimed empress of India.

**Afghan and Border Wars.** During 1876-78 a terrible famine ravaged Bombay, Madras and Mysore, in the course of which about 5,000,000 human beings perished. Lord Lytton was seriously involved with Afghanistan; he had the second Afghan War (1879-80) on his hands and took the opportunity to resign simultaneously with the Beaconsfield Ministry (April, 1880). The Marquess of Ripon succeeded to the viceroyalty in 1880, armed with instructions to reverse the Afghan policy of Lytton. During his term, which was remarkably peaceful, Ripon introduced a less autocratic note into the public administration, besides inaugurating useful reforms.

His successor was the Marquess of Dufferin (1884-88), who had been governor general of Canada. In 1885-86 occurred the third Burmese War, by which Upper Burma with the Shan States was annexed. He conciliated the Ameer Abdurrahman and opened negotiations for frontier settlements. The main task which fell to his successor, Lord Lansdowne (1888-94), was the settlement of the currency question. By closing the mints to the free coinage of silver and making gold legal tender, he secured a stability of exchange which greatly advanced trade and benefited the treasury. He successfully carried through the North-West frontier delimitation with Afghanistan, strengthened frontier defenses and increased the army.

The administration of the next viceroy—Lord Elgin (1894-99)—was laden with events and crises. An outbreak in Chitral (1895) compelled a large military



expedition to relieve the garrison of 543 men. In 1896-97 there were plague and famine, the latter affecting 300,000 square miles and a population of 70 millions. Border tribes from Chitral to Baluchistan attacked British garrisons in 1897, and some 40,000 troops were necessary in the consequent Tirah campaign. Boundary problems were settled with Russia on the Pamirs and with France on the Mekong, while frontiers were defined with China, Persia and Afghanistan.

**Lord Curzon.** Lord CURZON followed Elgin as viceroy in 1899. Curzon was then 40 years old, a man of immense energy, aggressive, and with a wide experience of government, politics, and Near East and Far East problems gathered by travel. He had already written several important works on these politico-geographic questions as they affected British interests. During his first term (to 1904), Curzon remodeled his predecessors' frontier policies—a source of chronic disturbance; he appointed commissions of inquiry on irrigation, railways, agricultural banks, education, police, taxation, usury and famine codes. He created a new political division, the North-West Frontier Province, to secure firmer control over troublesome, warlike tribes. Reforms were introduced in every department affecting the public welfare.

In 1902 Lord KITCHENER came to India as commander in chief. It was perhaps inevitable that two such powerful personalities like Curzon and Kitchener should clash, and it was believed for many years that this dissension was responsible for Curzon's resignation in 1905, shortly after he had been appointed for a second term. It was not until 1930 that Lord Middleton, who was secretary of state for India from 1903 to 1905, revealed that Curzon had been relieved because his views on Indian foreign policy were not those of the Cabinet. Nevertheless, Curzon's administration was rich in achievements, legislative, political and social. The Aden and the Perso-Afghan boundaries were delimited; a military mission proceeded to Tibet and secured a favorable treaty; Curzon obtained a perpetual lease of Berar from the nizam of Hyderabad (1903); he also divided up Bengal, too unwieldy for administrative purposes, and created a new province (1905). There was considerable Hindu opposition to this last measure, which was allayed by reuniting all the Bengali-speaking sections in 1912.

**Early Moves Toward Self-Government.** In his Indian Budget speech in the House of Commons in 1907, Mr. John (afterward Viscount) Morley foreshadowed important reforms in Indian administration, designed to associate the people more closely with the government. He nominated two Indian members to his own Council, and an Indian member to the Viceroy's Council. Thus Morley took the first steps, largely upon his own responsibility, to guide India toward self-government. In 1908, to mark the 50th anniversary of the transfer of India from the Company to the Crown, King Edward VII, in a message to the princes and peoples of India, reviewed the progress made during the half century and promised an extension of self-government. Important and influential classes among the Indians were learning to realize their own position and to estimate their own capacities; they compared their claims for equality of citizenship with those of the British people—India was developing a national self-consciousness.

In the years before World War I, the demand of educated Indians for a larger share in the government of their country grew more insistent, and this demand could find no adequate satisfaction within the framework of the Morley-Minto Constitution. Though this instrument gave Indians much wider opportunities for the expression of their views and increased their power of influencing the policy of government, the element of responsibility was entirely lacking. The ultimate decision rested in all cases with the government, and the councils were left with no functions save that of criticism.

**World War I.** When the World War came in 1914, a remarkable and unexpected outburst of loyalty and devotion to the king-emperor, and thus to the British connection, was manifested by the princes and peoples of India. Practically all the ruling chiefs placed their military forces and state resources at the disposal of the government. The country was almost denuded of British troops and even of native soldiers, yet there was no general uprising against the British, as had been predicted. The only disturbances occurred in the Punjab and a few other places, small riots started by Indian emigrants returned from Canada and the United States, agitators imbued with revolutionary ideas. India's contribution to the war amounted to more than a million men, and many workers for "labor-brigades" behind the battle lines. Of the Indian fighting forces that served under the British flag during the conflict, 73,432 were killed and nearly 85,000 wounded. Lord Hardinge's vice-regal term was extended to March, 1916. One of his last official acts was to put forward government proposals for postwar constitutional reforms. Lord Chelmsford succeeded him in April, 1916.

**Government of India Bill.** Lord Chelmsford's first year in office was marked by alarming symptoms of unrest and increasing agitation for constitutional changes toward "Home Rule for India." In 1917 Edwin S. Montagu became secretary of state for India. He had been assistant secretary under Morley and again under Lord Crewe; he had been in India and understood its problems. Toward the end of 1917 he paid another visit to India, made a wide survey and gathered a mass of official and public opinion. In 1918 a report was published, bearing the signatures of both Montagu and Chelmsford; in it an elaborate plan was recommended by which the Indian people by degrees would assume more and more responsibility in their government. The British Parliament in December, 1919, passed the Government of India bill, based upon the recommendations in the report. By this measure there was created in Indian administration a "diarchy," dividing political power between the native population and the Indian Civil Service. The report explicitly stated that this was merely a transitional measure, and that when India was ready for it, thoroughly representative government would follow.

**Economic and Political Crises.** During 1918-1919 conditions were exceedingly serious; drought brought a failure of crops and a resulting famine. Then the great epidemic of influenza which swept through the world in 1918 carried off a huge number of Indians, estimated at between seven and twelve millions. In May, 1919, a strong Afghan force poured across the frontier and proceeded to pillage in the Indian north-west provinces. British troops were quickly sent to check this unofficial warfare. British planes dropped some noisy bombs over Kabul and Jalalabad, which soon dissipated the Afghan enthusiasm for a "holy war." A treaty of peace was signed at Rawalpindi on Aug. 8, 1919, by which the subsidy hitherto paid by Britain was ended and the Afghan privilege of importing arms from India was withdrawn.

Throughout India the radical Nationalists grew increasingly aggressive; rioting and seditious activity so spread that the British authorities deemed it necessary to appoint a special committee to investigate and consider the whole situation. Headed by Justice Rowlatt, this committee recommended stringent repressive legislation which was embodied in the Rowlatt Bill, enacted in the spring of 1919. Serious disturbances in the Punjab and Delhi, resulting in many deaths, followed on a "passive resistance" movement inaugurated by Mahatma Gandhi against the Rowlatt measures. Opposition to them was intense, and for months rioting and terrorism spread over the country and reached its climax at Amritsar, where troops fired into a seditious mass meeting, killing nearly 400 and wounding 1,500 persons (April 13).

## India

**Gandhi.** One of the most important—and later the most powerful of all—of the implacable foes against British rule at this period was MAHATMA GANDHI, from 1919 leader of the Nationalists, a follower of Tolstoy, and an advocate of nonco-operation and passive resistance; and absolute boycott of the British government was his road to the independence of India. On February 14, 1922, at Chauri Chaura in the United Provinces, 21 policemen and watchmen were murdered by a mob of “volunteers.” A strike on the East Indian Railway complicated matters and forced drastic measures. Gandhi was arrested in March; he pleaded guilty at his trial for civil disobedience and was sentenced to six years’ imprisonment. He served less than two years of the sentence; while in prison he was operated upon for appendicitis and liberated unconditionally in January, 1924. During his incarceration other leaders had come to the front, and he had, apparently, lost his former influence. In 1925 he announced his intention to retire into seclusion for a year.

**Internal Reforms.** In 1926 the first railway electrification in India was inaugurated in Bombay, and in Madras the Mettur-Cauvery irrigation project, by which 300,000 acres would be brought under irrigation, was commenced. The Khyber Pass Railway (27 miles) from Jamrud to Landi Kotal on the Afghan border, was opened. The government also decided to prohibit the export of opium for medical purposes, thus initiating the measures provided for in the Geneva Protocol.

Lord Irwin (later Lord Halifax) succeeded Lord Reading as viceroy in April, 1926. During the year steps were taken to stamp out slavery in Burma; the slave liberation scheme in Nepal, formulated by the prime minister of that state, was completed at a cost of 275,000 pounds sterling, while slavery was also abolished in the state of Kalat, Baluchistan. In the elections for the Indian Assembly and provincial councils (Nov., 1926), the Swarajists gained a majority over any other group in the Assembly, and in the councils of Madras, Bengal, Bihar and Orissa, and the Central Provinces. Moslems and Hindus conducted a fierce communal and religious warfare; in most parts of India there were riots attended by great loss of life.

**Simon Commission.** In 1928 the historic “Simon Commission” arrived in India to report to what extent it was desirable to establish the principles of responsible government in India, or to extend, modify or restrict the degree of responsible government. The commissioners spent many months traveling about, taking evidence from representatives of all the chief communities and interests concerned, excepting only those Nationalists who refused to co-operate.

Briefly summarized, the recommendations included the grant of the utmost possible measure of independence to local governments within their own sphere, and the substitution in the central government, which should continue to deal with matters affecting British India as a whole (defense problems, foreign relations, communications, tariffs, etc.), of a federal system in place of the existing arrangements, for which no exact parallel could be found elsewhere in the empire. Measures were also proposed whereby representatives of the Indian States would join with representatives of British India for the discussion of matters of common concern in a “Council of Greater India,” to be appointed by royal proclamation. Constitutionally, this last recommendation was an innovation from which the most far-reaching consequences might ensue. The Commission insisted that the Constitution to be framed should be such as would not require to be revised and overhauled by external authority at stated intervals, but should contain within itself provision for adaptation by a process of natural growth, to meet new circumstances and changing conditions. The ideal of an All-India Federation was



GOVT. OF INDIA INFORMATION SERV.

**Mohandas K. Gandhi, surrounded by pressmen and followers after meeting with the viceroy in 1945**

held up as one to be attained by degrees as the feudatory states came to realize the desirability of entering into closer political relations with British India. As an essential preparatory step toward that object, the reconstruction of British India on a federal basis was advocated.

**Civil Disobedience.** In March, 1930, Gandhi started another “civil disobedience” campaign by leading a band of 80 followers from Ahmadabad to the village of Dandi, on the Gulf of Cambay. The march took 24 days, and its object was to dip up sea water and make free salt in defiance of the government monopoly and thus evade the salt tax revenue. The party was unmolested, but some riots developed in April when other villagers also made salt and the police interfered. On April 1, 1930, a new law came into effect, forbidding the marriage of children under the age of 14. This measure, also, aroused protests from Hindu orthodoxy.

**London Conference.** An event of tremendous historic importance was witnessed in London on Nov. 12, 1930, when an Indian “Round Table Conference” was opened, presided over by James Ramsay MacDonald, labor prime minister of Great Britain. For the first time a delegation of some 80 Indians, representing all races and religions and classes in India (except the Congress party) sat round a table with a delegation representing all parties and both Houses of the British Parliament to discuss, on a basis of complete equality and with nothing excluded from the purview of the conference, what the future of Indian government should be. For the first time Indian princes and their diwans sat round a table with the representatives of all classes in British India, also on terms of complete equality, and agreed together that the basis of the new constitution should be the inclusion of all-India within a single federal constitution under which responsibility both for central and local government should rest, subject to certain limitations, in Indian hands. For 10 weeks (until Jan. 19, 1931) the conference debated the weighty and intricate problems presented in the task of bringing together about 320,000,000 people speak-



ing different languages and of very different racial and religious character. The conference confined itself to tabling its proposals in outline in the faith that further discussion in India and Great Britain might in time produce something better, or that Indian opinion would rally to carry the scheme, however imperfect, to a mutually satisfactory consummation.

**Act of 1935.** Among the fruits of the notable London Conference was the Act of 1935 which Lord Halifax (then Lord Irwin), former viceroy, characterized as "the latest and greatest" of the latter-day enactments in the long course of political development of India. Under this act the provinces of British India could virtually govern themselves. That statute proposed that there should be a federation, consisting of the Indian States and British India, involving the functions of government for the whole of India. Under the viceroy a cabinet of Indians was to be formed, the viceroy retaining final responsibility for defense, for foreign policy, and for certain aspects of finance. All other subjects of a federal nature would be handled by the cabinet.

**Cripps Mission.** The Act of 1935 represented the constitutional position of India up to the time of World War II and the mission entrusted by the British government to Sir STAFFORD CRIPPS in the late winter of 1941-42. Only certain provisions of the act had been put into effect. Something had to be done not only to insure the future freedom of India but also India's alignment for its own protection from attack in the war. Gandhi and his followers pursued their tactics of passive resistance which they proposed to oppose to any Axis attack, while doggedly insisting upon the complete withdrawal of the British from India. In the midst of war, with the interests of the British Commonwealth of Nations and of the United Nations at stake, there could be but one result—the failure of the Cripps mission. The object was to create a new Indian union to constitute a dominion to be associated with the other dominions in common allegiance to the Crown and equal in every aspect of its domestic and external affairs. The British government declared: "that steps shall be taken immediately after the war to frame a new constitution for India; that the Indian States shall participate in the making of the constitution; that any non-acceding province of British India shall retain its present constitutional status; that for the period of the war the British government shall retain the responsibility for the defense of India".

**India in World War II.** In order to participate in the war effort India organized a volunteer army of two million men. The country also supplied munitions to the Allies. Almost the entire economy was mobilized for war production. Field Marshal Lord Wavell became the viceroy in October, 1943. By the latter part of 1943 Bengal was stricken by famine. The government succeeded in sending supplies to the starving communities. In order to prevent the outbreak of other famines, Lord Wavell created a department of planning which developed schemes to expand India's economic life. Plans were also worked out to increase the literacy rate of the country. Indian soldiers participated in the campaigns in North Africa, Italy, and Burma. The Indian Navy

and Air Force also participated effectively in the war effort.

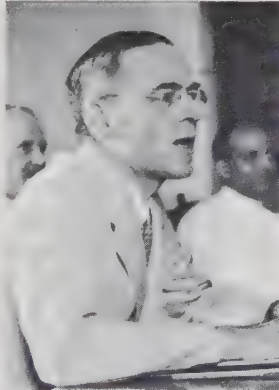
**Postwar Conditions.** On May, 1944, Gandhi was released from custody. A meeting was arranged in Bombay between Gandhi and JINNAH to arrive at a Hindu-Moslem understanding. But Jinnah did not agree to Gandhi's proposal that the Hindus and Moslems should work together to achieve independence. However, the meeting resulted in a report which proposed that India should become a dominion and that an Indian federation should be established. These proposals were not accepted. But the British government proposed the creation of a new executive authority in India which would be representative of Moslems and Hindus and would only retain the war ministry in British hands. Mainly due to the attitude of Jinnah this plan could not be carried out. At the end of 1945 disturbances broke out in India.

In the spring of 1946 elections for central and provincial legislatures were held. In the provinces the Congress party obtained 930 seats and the Moslem league won 428 seats. In the central assembly the Congress party obtained 56 seats and the Moslem league won 30 seats. Early in 1946 the British government sent a cabinet mission to India to help the Indians to create a constitution. The mission succeeded in obtaining the co-operation of the Congress party and the Moslem league for the creation of a constitution. But the mission failed in its efforts to create an interim government. Therefore the viceroy established an executive council which served as a temporary government.

In the July, 1946, elections for the constituent assembly the Congress party obtained 201 seats and the Moslem league won 73 seats. A month later an interim government was established of which NEHRU became the chief minister. The government was confronted with the following main problems; the readjustment of two million demobilized soldiers, the need for an accord between the Hindus and the Moslems, and the carrying out of plans to avert the threat of famine. But it was impossible to reconcile the conflicting views of the Moslems and the Hindus. Thus the constituent assembly opened on December 9, without the participation of the Moslem league.

**Indian Independence.** In March, 1947, Lord Wavell was replaced as viceroy by Earl Mountbatten. Rioting broke out in several parts of the country and was especially intense in Calcutta. Since the Indian leaders were unable to agree to a common plan, partition became the only alternative. Mountbatten flew to Britain to present a plan which provided for the establishment of India and Pakistan, to which all the powers hitherto exercised by the British would be transferred. On August 15, 1947, British power was transferred to these two dominions. Jinnah became governor general of the Moslem dominion of Pakistan. Mountbatten remained for the time being governor general of India, with Nehru as the powerful prime minister. Communal fighting disturbed the adjacent areas of the two countries after the gaining of independence. Mass migrations of Sikhs and Hindus into India and Moslems into Pakistan took place. By the middle of September about four million people were on the move. Disorders were confined to the north; in the south the transfer of power was accomplished peacefully. Both dominions were faced with the resettlement of millions of displaced persons.

In 1948 communal bitterness was dying down partially as a result of the assassination of Gandhi which filled all classes with shame. In February the draft of a constitution was made public and in June Mountbatten, the last British governor general, relinquished charge. In the meantime India lodged a complaint before the United Nations regarding its dispute with Pakistan over Kashmir. As a result of U.N. intervention a cease-fire order in Kashmir was issued by the governments of Pakistan and India in late 1948.



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In April, 1949, the conference of commonwealth prime ministers agreed that India would be a full member of the British Commonwealth of Nations. In the meantime the absorption of the princely states continued. The Kashmir dispute still dominated the political scene. In September, Nehru announced that India had rejected the United Nations Kashmir commission's proposal for arbitration. In October Nehru visited the United States, Canada, and Britain. In the same month India was elected to the Security Council of the U.N. The constitution came into effect on January 26, 1950, and India became an independent sovereign state within the British Commonwealth although its ties with the Commonwealth were tenuous.

The Communist challenge remained the major domestic political problem for the Indian government. Sabotage, arson and looting were employed by the Communists, who attempted to capture the trade unions and to dislocate the transportation system. In the rural regions the Communist-inspired activities assumed the proportion of agrarian revolts. Communist riots continued in 1950–51 while the government took a number of measures to curb the Communists. In September, 1950, famine conditions were reported in many parts of India. In 1951, the U.S. government sent relief shipments of grain to be used in famine areas.

The first national elections were held in 1952; the Congress party won a large majority and Prime Minister Nehru continued in office. India took a prominent role in international affairs as Nehru tried to follow a policy of neutrality between the United States and Soviet Russia. The Indian government offered a proposal which became the basis for the truce in the Korean War, and an Indian representative became umpire on the United Nations Repatriation Commission. In 1954 India accepted a similar role in Indochina to help carry out the terms of the truce there. India was disturbed when Pakistan signed a military aid pact with the United States, and it refused to join the South-East Asia Treaty Organization (SEATO). In 1955 Nehru was one of the sponsors of the Asian-African Conference which met at Bandung, Indonesia, to consider common international problems. G. B. DE H.; F. M.

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**INDIA, FEUDATORY STATES OF**, included the more than 560 states ruled internally, for the most part, by hereditary rulers prior to the division of the subcontinent into the states of India and Pakistan in 1947; area 715,964 sq. mi., pop. (1941)

93,189,233. By 1951 all the states except Kashmir had joined one of the two new governments; most of those joining India were merged in other states or new unions. See **INDIA, Feudatory States**.

**INDIA, FRENCH**, formerly consisted of five settlements under French sovereignty: CHANDERNAGOR, KARIKAL, MAHÉ, PONDICHÉRY, and YANAON; combined area 196 sq. mi.; pop. (1946 est.) 340,000. These tiny colonies were all surrounded on the land side by India proper. Mahé is on the southwestern coast not far from Calicut, Chandernagor is on the Hooghly River about Calcutta, and the other three are in the southeast along the coast line of Madras Province. Pondichéry was the capital.

**History.** The French first attempted to make an economic penetration into India in 1603, but this and several later efforts met failure. In 1664 a new company was organized, and four years later an agency was established at Surat. The company later took possession of Dutch and Portuguese settlements but after a few years lost them to the original owners. Finally the company purchased a small village at Pondichéry in 1683, and Chandernagor was acquired in 1688. Mahé, Karikal, and Yanaon came under French control in 1725–26, 1739, and 1752, respectively. Under JOSEPH FRANÇOIS DUPLEIX, governor general from 1742 until 1754, the French attempted to acquire a great empire in India, and for a time they were highly successful. The English, who had established similar settlements in India, thereupon took alarm, and as a consequence war broke out between the two rivals, which was merely the prelude to the struggle soon to take place both in Europe and America. After certain initial successes the French were stopped by an English military genius, Robert Clive. Dupleix was recalled to France in 1754 and his expansionist policy was abandoned, while the British were permitted to extend their power over the whole subcontinent. During the wars between France and Great Britain after the French Revolution the settlements were occupied by the British, but were restored in 1816 on condition that they remain unfortified. After the British withdrew from India in 1947 the new dominion demanded that the settlements be transferred to it. A plebiscite was held in Chandernagor in 1949, and the transfer to the new sovereignty was made on May 2, 1950. After long negotiations the other areas were ceded to the Republic of India on Nov. 1, 1954. F. M.

**INDIA INK.** See **INK**.

**INDIA, PORTUGUESE**, partially autonomous possessions of Portugal consisting of islands and mainland scattered along the W coast of the subcontinent of India, including Gôa on the Malabar Coast, and the islands of Anjediva, São Jorge, and Morcegos; Diu with the mainland possessions of Gocola and Simbor on the Gujarat coast; and DAMÃO and the separated tracts of Nagar Avely and Dadará on or near the Gulf of Cambay; area 1,537 sq. mi.; pop. (UN 1951 est.) 639,000. The capital is Nova Gôa (Pangim), residence of the governor general. The chief occupations are reclaiming salt, agriculture, fishing, and mining. The chief exports are manganese, coconuts, fish, spices, nuts, salt, and copra. Deposits of manganese were discovered near Gôa in 1906 and are now mined. The scattered areas have more than 500 elementary and 12 secondary schools, as well as medical and teachers' training colleges. The Portuguese Admiral Albuquerque took Gôa in 1510, and since then it has remained in Portuguese possession, although attacked at various times by the Dutch and English. Gôa became the central point for Christian missionaries in the Far East, St. FRANCIS XAVIER arriving at Gôa in 1542. Gôa's archbishop is primate of the East and patriarch of the East Indies. After India became a dominion in 1947 it demanded that the Portuguese possessions be ceded to it. During 1954 there was much tension in Gôa over the issue.

**INDIA, STAR OF.** See **ORDERS OF KNIGHTHOOD**.





## KING JAMES VERSION OF THE BIBLE

*Called Supreme Masterpiece in English Language*

TO SAY THAT the Bible has had a greater influence on life and letters in the English-speaking world than any other book is an understatement. Indeed, some writers have implied that its influence in Britain and America has surpassed that of most of the other books put together. In our time when one speaks of the Bible as literature one usually has in mind the King James version. It is known also as the authorized version and is used by all Protestant denominations in English-speaking countries.

It is the one that Milton read, and Cromwell and William Blake. The same is true for Carlyle and Ruskin and Byron, Browning and Arnold and Tennyson, Gladstone and Huxley, George Eliot and Florence Nightingale. Countless other famous figures in both the Old and the New World could be added to the list of those who have turned to this version of the Bible for solace and assurance. The framers of the Declaration of Independence and the Constitution, Lincoln and Lee, Whitman and Whittier, Emerson, Bryant, and Longfellow all drew inspiration from the same version of the Book of Books.

The first attempts to put any part of the Bible into English were made in the seventh century. These were poetical paraphrases of brief passages from the Latin Vulgate. In every century since then at least parts of the Bible have been paraphrased, translated, or revised in English-speaking countries. The most noteworthy versions brought out prior to the invention of printing are the two 14th-century translations associated with the name of Wycliffe.

In the 16th century came the first printed translations. The year 1525 saw the printing in Germany of William Tyndale's English translation of the New Testament. In 1535 the whole Bible was, for the first time, printed in English. It was prepared by Coverdale. Not long thereafter was published the so-called Great Bible (1539) and then the Geneva Bible (1560).

Next came the Bishops' Bible. This revision of the Great Bible was carried through under the direction of Archbishop Parker, and was completed in 1568. Following its publication, the Roman Catholics in England brought out the Douay version, a new translation of the Latin Vulgate.

Work on the celebrated King James version was launched by James I in 1604, and the first edition came off the press in 1611. Basically a revision of the Bishops' Bible, it was prepared by 54 leading scholars of the time, the most noted of them being the renowned Lancelot Andrewes. They turned out what has come to be regarded as the supreme literary masterpiece in the English language. See BIBLE; COVERDALE, MILES; ENGLAND, CHURCH OF; REFORMATION; TYNDALE, WILLIAM; VULGATE; WYCLIFFE, JOHN.











*King James I*  
EXAMINING FIRST COPY  
OF THE TRANSLATION  
OF THE HOLY BIBLE  
WHICH HE SPONSORED

LONDON • 1611



